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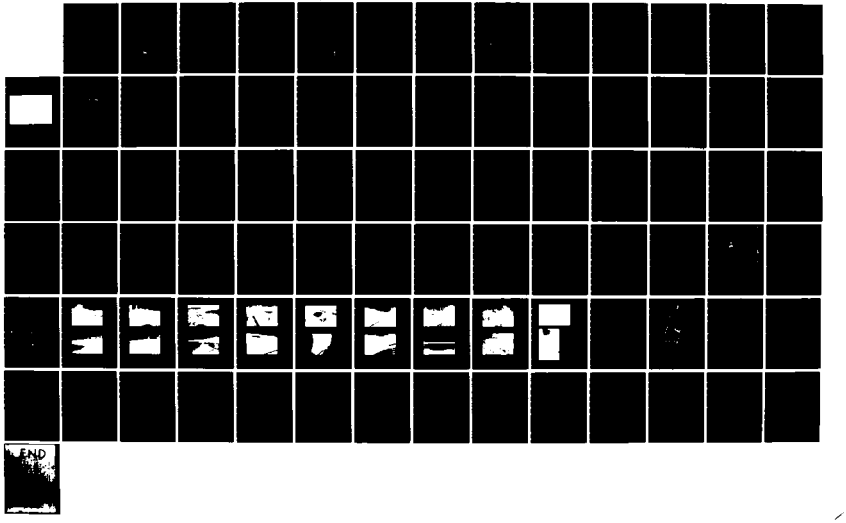

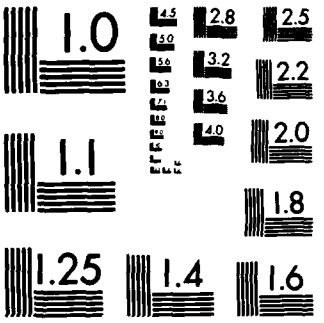

PAWCATUCK RIVER BASIN
NORTH STONINGTON, CONNECTICUT

AD-A144 627

WYASSUP LAKE DAM
CT. 00570

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

AUGUST, 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Pawcatuck River Basin
North Stonington, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam at Wyassup Lake is an earth embankment approximately 495 feet in length, including a spillway crest length of 20 feet. The maximum height of the dam is 15 ft. The dam is judged to be in FAIR condition. The dam is classified as SMALL in size and a SIGNIFICANT hazard structure. The selected test flood inflow for this dam is equal to ½ the PMF.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

OCT 15 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Wyassup Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, State of Connecticut, Depat. of Environmental Protection, Region 4.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

WYASSUP LAKE DAM

CT 00570

PAWCATUCK RIVER BASIN

NORTH STONINGTON, CONNECTICUT

PHASE 1 INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION REPORT

IDENTIFICATION NO.:	CT 00570
NAME OF DAM:	Wyassup Lake Dam
COUNTY AND STATE:	New London County, Connecticut
STREAM:	Wyassup Brook
DATE OF INSPECTION:	April 9, 1980

BRIEF ASSESSMENT

The dam at Wyassup Lake is an earth embankment approximately 495 feet in length, including a spillway crest length of 20 feet. The maximum height of the dam is 15 feet. The upstream slope of the dam is approximately 1V on 3H and is protected from the crest of the dam to several feet below the spillway crest level by riprap. The downstream slope is 1V on 2H and is loamed and grassed. The outlet works for the dam consists of an inlet headwall structure, a 24-inch diameter pipe through the embankment to a 6 feet square concrete manhole control structure midway through the embankment and a 24-inch diameter discharge pipe that exits in the downstream sidewall of the spillway overflow. Flows are controlled by a manually operated 24-inch sluice gate operated from the crest of the dam. The overflow spillway is a reinforced concrete structure with a weir length equal to 20 feet.

As a result of the visual inspection, the dam is judged to be in FAIR condition. Deficiencies observed include: an inadequate spillway capacity to pass the "test flood"; lack of complete riprap protection along the upstream slope, particularly at abutment areas; depressions noted in the crest of the dam that could be the result of embankment movement; and the partially inoperative outlet works gate.

The dam is classified as SMALL in size and a SIGNIFICANT hazard structure in accordance with the recommended guidelines established by the Corps of Engineers. The selected test flood inflow for this dam is equal to one-half the PMF or 2150 CFS and the routed test flood outflow is equal to approximately 925 CFS and would overtop the dam by 0.6 feet. The maximum spillway discharge of 300 CFS represents 32 percent of the total test flood outflow.

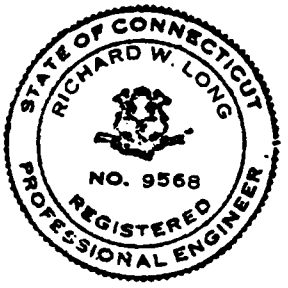
It is recommended that the Owner engage the services of a qualified registered engineer to accomplish the following: perform detailed hydraulic and hydrologic studies to further assess the need for and means to increase the project discharge capacity, extend the riprap protection on the upstream slope to cover eroded areas, rehabilitate the outlet

works gate, investigate the cause of depressions along the crest and develop a regular inspection and maintenance program.

Additional recommendations and remedial measures are detailed in Section 7 and should be implemented by the Owner within one year after receipt of this Phase 1 Inspection Report.

CE MAGUIRE, INC.

By Richard W. Long
Richard W. Long, P.E.
Vice President



This Phase I Inspection Report on Wyassup Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or to property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain condition which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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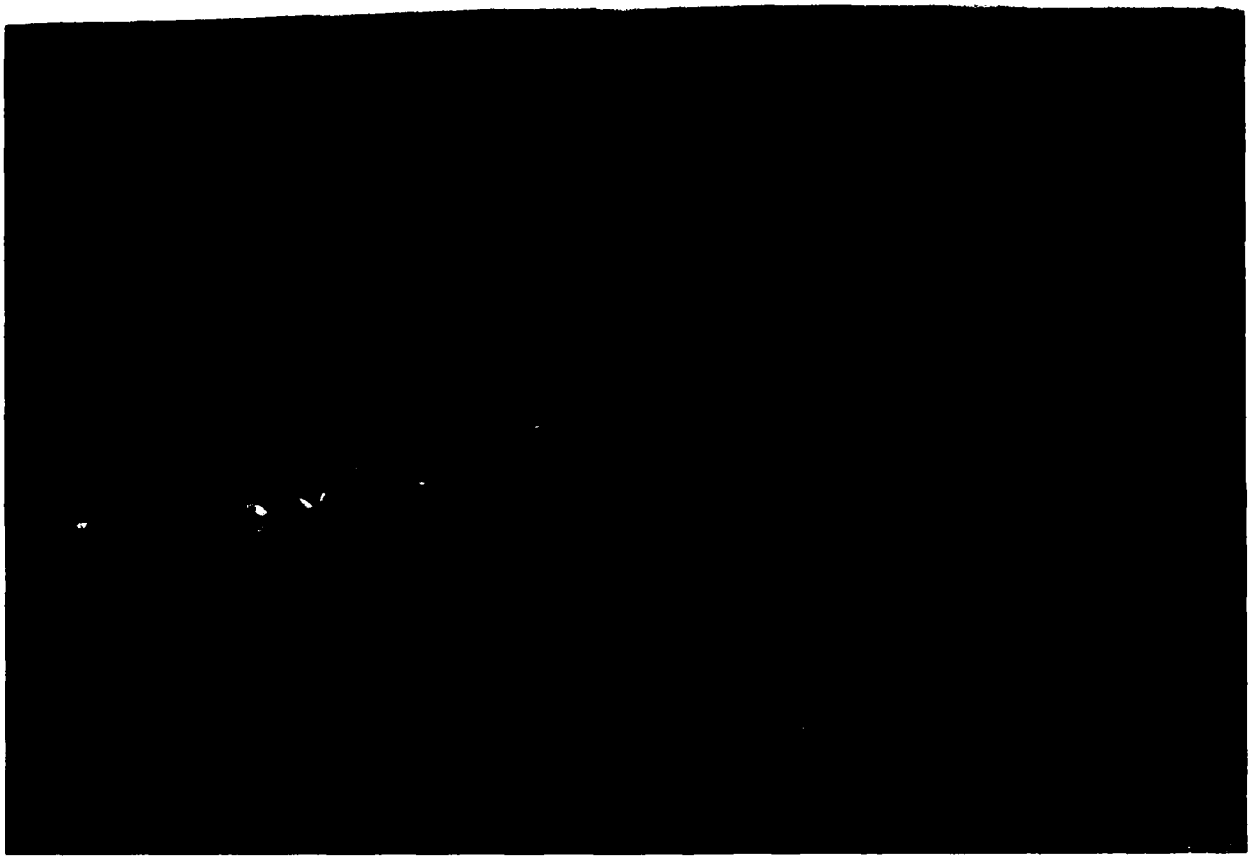
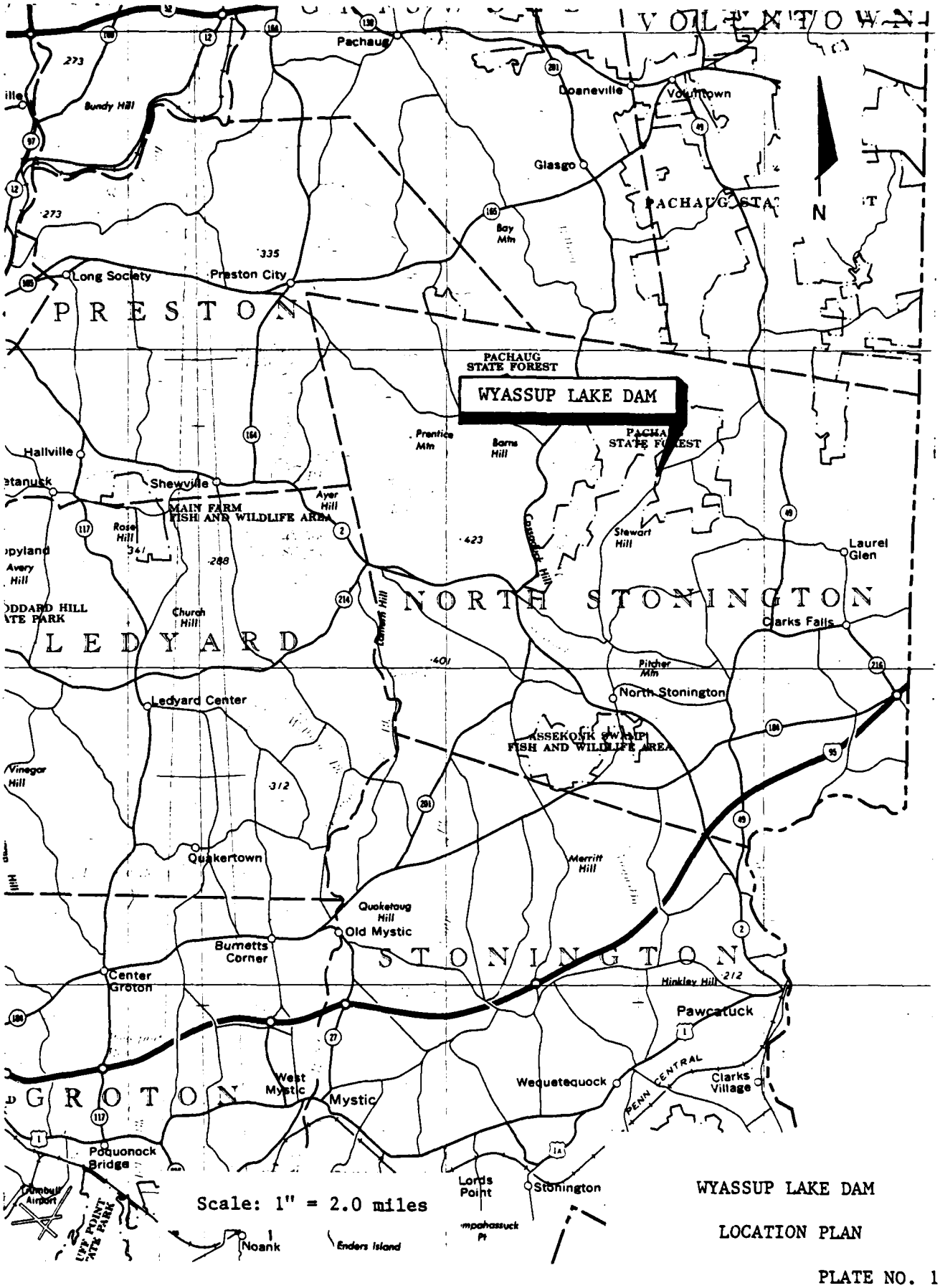
APPENDICES



OVERVIEW PHOTO - Wyassup Lake Dam



Scale: 1" = 2.0 miles

WYASSUP LAKE DAM

LOCATION PLAN

PLATE NO. 1

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION REPORT

WYASSUP LAKE DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. CE Maguire, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to CE Maguire, Inc. under a letter from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-80-C-0013 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection.

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify, and complete the National Inventory of Dams.

1.2 Description of the Project

a. Location. Wyassup Lake Dam is located in the Town of North Stonington, New London County, Connecticut, approximately 3.4 miles north of the Village of North Stonington, along Wyassup Lake Road. Coordinates of the dam are approximately 41°29.6'N Latitude and 71°52.4'W Longitude. The dam impounds water from Wyassup Brook which drains a 0.9 square mile watershed of rolling undeveloped terrain. The reservoir has a total surface area of 93 acres at the spillway crest level. The axis of the dam is oriented in a northeast-southwest direction with the reservoir to the northwest.

b. Description of Dam and Appurtenances. The dam at Wyassup Lake is an earth embankment approximately 495 feet in length, including a spillway crest length of 20 feet. The maximum height of the dam is 15 feet. The upstream slope of the dam is approximately 1V on 3H and is protected from the crest of the dam to several feet below the spillway crest level by riprap. The downstream slope is 1V on 2H and is loamed and grassed. The outlet works for the dam consists of an inlet headwall structure, a 24-inch diameter pipe through the embankment to a 6-feet square concrete manhole control structure midway through the embankment and a 24-inch diameter discharge pipe that exits in the downstream sidewall of the spillway overflow. Flows are controlled by a manually operated 24-inch sluice gate operated from the crest of the dam. The overflow spillway is a reinforced concrete structure with a weir length equal to 20 feet.

c. Size Classification. Wyassup Lake Dam has a height of 15 feet and an impoundment capacity at the top of the dam equal to 800 Ac.-Ft. In accordance with the Corps of Engineers criteria the dam is therefore classified as SMALL in size based on both height and storage.

d. Hazard Classification. The dam is classified as a SIGNIFICANT hazard structure because its failure could result in damage to Wyassup Lake Road and Grindstone Hill Road. Dam failure may also temporarily disrupt utility services located within the roadway rights of way. It is estimated that water depths due to the failure discharge of 4692 CFS may range from 7 feet at the dam to 8 feet at a distance of 7000 feet downstream from the dam. The failure will cause flooding, and high velocities that will carry debris which could increase the potential for damage.

e. Ownership. The Wyassup Lake Dam is owned by the State of Connecticut and operated by the Department of Environmental Protection, Region 4.

f. Operator. Operation of the dam is the responsibility of Region 4, Department of Environmental Protection.

Operator: M. Roberts, Unit Manager
Pachaug State Forest
(203) 376-4075

g. Purpose of Dam. Recreation

h. Design and Construction History. There are no records of the original construction of the dam. The State of Connecticut purchased the dam in 1958 and rebuilt the dam in 1963 to its present configuration. No other work has been recorded at the damsite.

i. Normal Operational Procedures. There are no operational procedures for regulation of the water surface at Wyassup Lake.

1.3 Pertinent Data

a. Drainage Area. The Wyassup Lake watershed, located in New London County, North Stonington, Connecticut, is oblong in shape with an approximate length of 9000 feet, a maximum width of 3500 feet and a total drainage area equal to 0.906 square miles. (See Appendix D for Basin Map). About 10 percent of the basin is swampy providing natural storage. The topography is generally undeveloped woodland with rolling terrain that varies from a high of elevation 520 feet at Chapman Hill to elevation 301 feet at the damsite. Basin slopes average 0.04 feet/feet and are considered moderate. The time of concentration for the entire watershed is estimated to be approximately 35 minutes and is relatively small which should cause all runoff to peak simultaneously at the dam during a high intensity rainstorm. The basin swamps tend to moderately attenuate the peak runoff.

b. Discharge at Damsite. There is limited discharge data available for this dam. The estimated extreme freshet for this dam is equal to 100 CFS. Listed below are other discharge data for spillway and outlet works:

1. OUTLET WORKS:

Conduit size	24-inch diameter pipe invert elevation 290.75 feet
i) Discharge capacity	50 CFS at spillway crest elevation 301 feet
ii) Discharge capacity	56 CFS at top of dam elevation 303.75 feet
iii) Discharge capacity	58 CFS at test flood elevation 304.35 feet
2. Maximum known flood at damsite:	100 CFS (est.)
3. Ungated spillway capacity at top of dam	300 CFS
4. Ungated spillway at test flood flood elevation	N/A (dam overtopped) at test flood elev.)
5. Gated spillway capacity at normal pool elevation	N/A

6.	Gated spillway capacity at test flood elevation	N/A
7.	Total spillway capacity at test flood elevation	N/A
8.	Total project discharge at top of dam	352 CFS
9.	Total project discharge at test flood elevation.	983 CFS

c. Elevations (Feet above NGVD)

1.	Streambed at toe of dam	288.75
2.	Bottom of cutoff	290.75
3.	Maximum tailwater	Unknown
4.	Recreation pool	301.00
5.	Full flood control pool	N/A
6.	Spillway crest (ungated)	301.00
7.	Design discharge (original design)	Unknown
8.	Top of dam	303.75
9.	Test Flood level	304.35

d. Reservoir Lengths (in feet)

1.	Normal pool	2,000
2.	Flood control pool	N/A
3.	Spillway crest pool	2,000
4.	Top of dam pool	2,000
5.	Test flood pool	2,000

e. Storage (Acre-Feet)

1.	Normal pool	553
2.	Flood control pool	N/A

3.	Spillway crest	553
4.	Top of Dam	800
5.	Test flood pool	870
f.	Reservoir Surface Area (Acres)	
1.	Normal pool	90
2.	Flood Control pool	N/A
3.	Spillway crest	90
4.	Test flood control	90
5.	Top of dam	90
g.	Dam	
1.	Type	Earth embankment constructed over masonry dam
2.	Length	495 feet
3.	Height	15.0 feet
4.	Top width	15.0 feet
5.	Side slopes	Upstream IV on 3H Downstream IV on 2H
6.	Zoning	Impervious core
7.	Impervious core	Selected soil materials
8.	Cutoff	Full
9.	Grout curtain	None
10.	Other	---
h.	Diversion and Regulating Tunnels	N/A
i.	Spillway	
1.	Type	Uncontrolled, overflow, concrete broad-crested

2.	Length of weir	20.0 ft.
3.	Crest elevation	301.0 feet
4.	Gates	None
5.	U/S Channel	Natural bed of reservoir
6.	D/S Channel	Natural bed of brook
7.	General	Concrete downstream 1:2 sloping type weir

j. Regulating Outlets

Refer to Paragraph 1.2b "Description of Dam and Appurtenances" Page 1-2 for description of outlet works.

1.	Downstream invert	290.75
2.	Size	2.0 ft. dia. pipe
3.	Description	Concrete - rectangular well
4.	Control Mechanism	Manually operated sluice gate.
5.	Other	Control not covered by a gatehouse but has a bolted manhole type cover (See attached drawings)

SECTION 2

ENGINEERING DATA

2.1 Design Data

The following documents which contain the principal information available for this dam and its appurtenances were reviewed in the preparation of this report:

1. State of Connecticut, Public Works Department - Repair of Dam at Wyassup Lake, North Stonington, Connecticut, Plans prepared by Onordonk & Lathrop, Consulting Engineers, Glastonbury, Ct.

Plan and Sections	Sheet 1 of 3
Spillway	Sheet 2 of 3
Details	Sheet 3 of 3
Details	Sheet 3A Supplementary Drawing.

2. Specifications - Repair of Dam at Wyassup Lake - Project No. B1-BB-50B.

2.2 Construction Data

No record of construction or subsequent repairs is available for this dam. The above referenced drawings are assumed to reflect the existing conditions.

2.3 Operation Data

No record of operation for this facility is available.

2.4 Evaluation of Data

a. Availability. The information noted above for this facility is available in the files of the Department of Environmental Protection, State of Connecticut.

b. Adequacy. The lack of in-depth engineering data did not allow a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on the visual inspection, the dam's past performance and sound engineering judgement.

c. Validity. The validity of the limited information available must be verified.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The Phase 1 inspection of the dam at Wyassup Lake Dam was performed on 8 April, 1980 by representatives of CE Maguire, Inc. and Geotechnical Engineers, Inc. A visual inspection checklist and photographic record of that field work are included in Appendix A and C, respectively. of this report.

Based on the visual inspection, history and general appearance, the dam is judged to be in FAIR condition.

b. Dam. The dam consists of two earth embankments separated by a 45-foot-long section of natural ground (Photo C-1). The left embankment is 300 feet long and has a 20-foot-long concrete chute spillway near the center of the embankment. The spillway crest is 2.75 ft below the left embankment crest. The right embankment is 150 ft. long.

The upstream slope of the left embankment has riprap slope protection extending to within 2 ft of the crest of the embankment (Photos C-5 and 6). Small brush was observed to be growing between the riprap (Photo C-6). The upstream slope at the right abutment contact had no slope protection and was eroded by wave action. Note that the stone wall in Photo C-1 corresponds to the natural ground that separates the two sections of the dam. The water level at the time of inspection was 2.74 feet below the elevation of the crest. The upstream slope above the riprap was grass covered and irregular. (Photos C-1, 2, 5, 6, 15 and 16).

The upstream slope of the right embankment had riprap slope protection extending to within 2 to 3 feet of the crest (Photos C-1 and 2). Small brush was observed to be growing between the riprap. The water level at the time of inspection was about 1 foot below the top of the riprap. The left and right abutments had no riprap protection, and extensive erosion by wave action was observed to have cut significantly into the slope (Photo C-15). The upstream slope above the riprap was grass covered and very uneven with considerable sloughing near the crest (Photo C-2).

The crest of the left embankment is grass covered and generally in good condition. A shallow (up to 6 inches deep) depression 15 feet long and 2 feet wide was observed 6 feet from the downstream edge of the crest approximately 80 feet from the right abutment (Photo C-16). A second depression (up to 4 inches deep) approximately 5 feet long and 1 foot wide was observed 6 feet from the downstream edge of the crest approxi-

mately 15 feet left of the intake gate. The minimum width of the crest is 15 feet. The crest of the right embankment is grass covered and in generally good condition.

The downstream slope and toe of the left embankment between the left abutment and the spillway is covered with grass and small brush (Photo C-3). An extensive wet area was observed 10 to 15 feet downstream from the toe of the left embankment between the spillway and the left abutment. Overflow from a well located downstream from the toe on the left abutment has eroded a ditch 12 inches deep leading away from the toe of the embankment (Photo C-18). The water level in the well (not in use at the time of the inspection) was Elevation 296.02 feet (NGVD), and was below the reservoir elevation upstream of the embankment. The downstream toe and slope between the right abutment and the spillway is grass covered and irregular, exhibiting minor sloughing and erosion, especially near the right abutment (Photo C-4). A low area containing standing water was observed 50 feet downstream from the toe of the embankment at the toe of the right abutment. The low area did not have a natural outlet. Available drawings indicate that this area was the former location of the overflow spillway. The origin of this standing water is not known, but it probably originates from seepage through the right abutment.

The downstream slope of the right abutment is grass covered and has a slope of 1V on 2H (Photo C-4). A 10-inch diameter tree stump is located at the toe of the right embankment approximately 15 feet from the right abutment (Photo 9). A wet area surrounding a smaller area of brush was observed on the downstream slope and toe at the right abutment contact (Photo C-17).

c. Appurtenant Structures

1. Spillway. A concrete-chuted spillway 20 feet wide is located 125 feet from the right abutment of the left embankment (Photo C-7). The approach channel was submerged and could not be inspected; however, large riprap placed upstream of the spillway weir was visible. The concrete spillway weir and discharge chute appeared to be in good condition (Photos C-7 and 8). Minor erosion was observed at the base of the right training wall. Minor erosion and spalling were also observed at the base of the left training wall and at the low-level outlet located on the downstream end of the wall (Photo C-11). Water was observed to trickle from the 6-inch-diameter outlets in each training wall servicing the toe drains for the left embankment.

2. Outlet Works. The low-level outlet consists of a 24-inch-diameter asbestos-bonded steel conduit extending from the upstream toe to its discharge outlet into the spillway discharge channel (Photo C-11). The conduit is gated beneath the downstream edge of the crest with access to the gate provided by a reinforced concrete manhole located at Station 3+40 along the dam. Concrete on the manhole appeared to be in good condition, and concrete at the outlet was in fair condition. The asbestos-bonded steel conduit could not be inspected. (See Photos C-9 and 10). The outlet works gate was operated during the visual inspection and found to be operable but limited in opening range because of a bent gate stem.

d. Reservoir Area. The shoreline area of Wyassup Lake is flat to moderately sloped with vegetation and trees covering the banks. Floating debris could obstruct the overflow spillway, or more easily the downstream channel, causing localized flooding. No evidence of shoreline sloughing or severe bank erosion was observed. (See Photo C-14).

e. Downstream Channel. The downstream channel of the spillway is the natural streambed covered with boulders at the downstream end of the spillway chute and stone and gravel further downstream from the spillway (Photo C-12). Weeds and small brush grow in the center and on the edges of the narrow channel. Further downstream the channel passes beneath Wyassup Lake Road through a roadway culvert (See Photo C-13).

3.2 Evaluation

Based on visual inspection, the dam appears to be in fair condition. The following features could adversely affect the future performance of the dam:

1. Lack of riprap protection at the right abutment of the left embankment and the left and right abutments of the right embankment could permit the continued erosion of those embankments.

2. Brush growing between riprap on the upstream slopes of the left and right embankment could dislodge the stones and encourage wave erosion.

3. Brush growing at the downstream toe of the left embankment could make future inspection of the wet areas observed during the recent inspection difficult or impossible.

4. Depressions along the crest could be the result of minor movements of the downstream slope or of differential settlements associated with a clay core existing downstream of the original masonry wall.

5. The gate stem for the outlet works control should be straightened and the protective cover made vandal proof.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. The storage at Wyassup Lake dam is used for recreation. The impoundment is generally not regulated and all downstream discharges are the result of spillway overflows.

b. Description of Any Warning System. The Wyassup Lake dam is visited several times during the week and daily during high intensity rainfalls by the Unit Manager for the Pachaug State Forest. During emergency situations, the local unit personnel would notify, as the conditions warrant, their Regional Director, Department of Environmental Management, State of Connecticut in Hartford, as well as the First Selectman for the Town of North Stonington.

4.2 Maintenance Procedures

a. General. The Pachaug State Forest Unit of the Department of Environmental Protection is responsible for all maintenance at the dam. Typically, the maintenance is limited to trimming of brush and mowing of grass on the embankment. Property owners adjacent to the dam also assist the State by trimming and mowing the dam crest and slope during the summer recreation season.

b. Operating Facilities. The outlet works gate was operated during the visual inspection and was operable but could not be opened fully because of a bent gate control stem which needs to be repaired. Operational tests of the gate are performed on a regular basis annually. It was reported that Wyassup Lake was partially drained through this outlet in the fall season of 1978 to permit shoreline owners to repair boat piers and other shoreline structures.

4.3 Evaluation. Observations of the dam are conducted on a regular basis and operational equipment tests also performed. Minor maintenance (grass and brush trimming) appears to be suitable for the facility. Major deficiencies that are found would be reported directly to the regional office in Hartford and a program of repair established depending on the severity of the item. Maintenance procedures are judged to be adequate for the structure.

Emergency procedures and notification of proper authorities also are adequate for the dam. Included in the plan should be the locations of emergency equipment, materials, and personnel as well as a dewatering procedure to prevent or minimize dam failures or overtopping. Field unit managers should be briefed and alerted to potent-

ially hazardous signs and areas to check in the field at the dam on a regular basis in order to provide the department with adequate time for repair, rehabilitation or notification of impact area residents.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General. It is assumed that Wyassup Lake Dam was constructed in the early part of the twentieth century. The dam is located on Wyassup Brook in the Pawcatuck River Watershed in Connecticut. This reservoir has a gross drainage area of 0.906 square miles and is located adjacent to Wyassup Lake Road. The watershed has moderate slopes and a small percentage of its area is covered by natural storages and swamps. The shape, slope and time of concentration of the basin indicate a large value of runoff can be expected from rainfall events. There is no gaging station located within the basin or near the damsite. The lake has a storage capacity of 553 Ac-Ft. at the spillway crest elevation and a large surface area equal to 90 acres.

This dam has a spillway length of 20 feet and a total surcharge height of 2.75 feet. The total length of the dam is 495 feet. The lake has a total storage capacity of 553 Ac-Ft. at the spillway crest elevation of 301 feet and can accommodate 11.44 inches of runoff from the 0.906 square mile watershed. Every foot of depth in the reservoir above the spillway crest can accommodate a volume of 90 Ac-Ft. of water equivalent to 1.86 inches of runoff.

5.2 Design Data. There is limited design data available for this watershed. In lieu of existing design information, U.S.G.S. Topographic Maps (Scale 1" = 2000') were utilized to develop hydrologic parameters such as drainage areas, reservoir surface areas, basin slopes, time of concentration and other runoff characteristics. Elevation - storage relationships for the reservoir were approximated. Surcharge storage was computed assuming that the surface area remained constant above the spillway crest. Some of the pertinent hydraulic design data was obtained and/or confirmed by actual field measurements at the time of visual field inspection.

Test flood inflow/outflow values and dam failure profiles were determined in accordance with the Corps of Engineers guidelines. Final values in this report are approximate only and are no substitute for actual detailed analysis.

5.3 Experience Data. No historical data for recorded discharges or water surface elevations is available for this dam.

5.4 Test Flood Analysis: Recommended guidelines for the Safety Inspection of Dams by the U.S. Army Corps of Engineers were used for the selection of the Test Flood. This Dam is classified under those guidelines as a SIGNIFICANT hazard and SMALL in size. Guidelines indicate that a 100 year to one-half PMF be used as a range of test floods for such classification. The watershed has a total drainage area of 0.906 square miles, of which 10 percent is swampy or natural storage. The drainage area is undeveloped, largely wooded and is

hilly with rolling terrain. Average basin slopes are 0.04 ft/ft. which are considered moderate. Because Wyassup Lake is heavily used for recreation and its loss would impact significantly on the shoreline owners, a test flood equal to one-half PMF was adopted for this analysis. This test flood was calculated to equal 2400 CSM or 2150 CFS. Outflow discharges were also developed using Corps of Engineers criteria for approximate routing techniques. The routed outflow discharge for the test flood inflow is 925 CFS. The spillway and outlet rating curves are illustrated in Appendix D. Flood routings were performed assuming a full reservoir up to the spillway crest.

It was determined that the spillway capacity is hydraulically inadequate to pass the test flood and the flow would overtop the dam by approximately 0.6 feet assuming an overflow length of dam equal to 475 feet. The inflow and outflow discharge values for this test flood are 2150 CFS and 925 CFS, respectively. The maximum outflow capacity of the spillway without overtopping of the dam is 300 CFS which represents 32 percent of the test flood overflow discharge.

At the spillway crest elevation of 301 feet, the capacity of the outlet works is 50 CFS. It requires 21 hours to lower the reservoir level the first foot assuming a surface area of 90 acres. For the 553 Ac-Ft. of available storage below the spillway crest, it will require 11 days to drain this reservoir through the existing outlet. One foot of depth in the reservoir at the spillway crest can accommodate approximately 1.86 inches of effective rainfall. Consequently, it is estimated that overtopping of the dam by the test flood can be eliminated if the pool level in the reservoir is kept 2.5 feet below the spillway crest.

5.5 Dam Failure Analysis. An instantaneous full-depth partial-width breach of 45 feet was assumed to have occurred in this dam. This will result in an unsteady flow phenomenon with one flood wave travelling up into the reservoir and rebounding to feed the other wave travelling downstream into the valley.

The calculated dam failure discharge of 4692 CFS assuming the impounded water level is at the top of the dam (Elevation 303.75), will produce a flood wave stage of Elevation 297 feet immediately downstream from the dam. This will raise the water surface approximately 6.0 feet above the depth just prior to failure when the discharge is 300 CFS. The dam failure analysis covered that reach extending from the dam to a point 7000 feet downstream. Normal uniform flow, following Manning's formula, will occur at that point.

Failure of Wyassup Lake Dam could result in damage to Wyassup Lake Road and Grindstone Hill Road. Dam failure may also temporarily disrupt utility services located within the roadway rights of way. It is estimated that water depths due to the failure discharge of 4692 CFS may range from 7 feet at the dam to 8 feet at a distance of 7000 feet downstream from the dam. The failure will cause flooding, and carry debris which could increase the potential for damage. The dam is classified as a SIGNIFICANT hazard structure.

WYASSUP LAKE DAM

Inflow, Outflow and Surcharge Data

FREQUENCY IN YEARS	24-HOUR TOTAL RAINFALL IN INCHES	24-HOUR* EFFECTIVE RAINFALL IN INCHES	MAXIMUM INFLOW IN CFS	MAXIMUM** OUTFLOW IN CFS	SURCHARGE HEIGHT IN FEET	SURCHARGE STORAGE ELEVATION
100	7.0	4.6	920	270	2.48	303.48
½ PMF	11.9	9.5	2150	925	3.35	304.35

*Infiltration assumed as 0.1"/hour
**Lake assumed initially full at spillway crest elevation 301.0 (top of dam = 303.75)

NOTES:

1. Q_{100}; inflow discharges were computed by the approximate methodology of the Soil Conservation Service.
2. ½PMF and "test flood" computation based on COE instructions and guidelines.
3. The maximum capacity of the spillway without overtopping the top of the dam elevation (303.75) is equal to 300 CFS.
4. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.
5. Test flood = one-half PMF = 2,400 CSM = 2,150 CFS (D.A. = 0.906 sq. miles).

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation. The visual observations did not disclose evidence of present structural instability of the dam or spillway except possibly for the depressions on the crest which could indicate minor movements of the downstream slope.

Conditions observed that may lead to future instability of the dam include:

1. Continued erosion of the upstream slopes at the right abutment of the left embankment and at the left and right abutments of the right embankments due to the lack of slope protection at these locations.

2. Brush growing between riprap on the left and right embankment could dislodge the stones and result in erosion of the soil materials.

6.2 Design and Construction Data. In 1963 extensive construction took place to renovate the original Wyassup Lake Dam, completed in 1920. According to an inspection report dated November 13, 1957, the original dam consisted of a 250 foot-long earth fill dam with a dry stone masonry wall on the down stream side. The maximum height of the dam was 12 feet. To the right of this dam was a similar dam of similar construction, with a length of 100 feet and a height of 6 feet. The original spillway was only 5.3 feet wide.

Renovations to the dams included:

1. Raising the crest elevation of the dams by about 1.5 feet.

2. Replacing the low-level outlet and spillway.

3. Placement of a zone of impervious fill adjacent to the downstream face of the dry stone masonry walls.

4. Placement of pervious fill and riprap on a 1V:3H slope on the upstream slope of the dam.

5. Placement of pervious fill to form a 1V:2H downstream slope.

6. Installation of toe drains on the larger dam.

Details of the as-built plans and sections of the dam are given in drawings prepared for the Public Works Department of the State of Connecticut, dated July, 1963 and presented in Appendix B.

6.3 Post-Construction Changes. There are no records of changes made to these dams after reconstruction in 1963.

6.4 Seismic Stability. The dam is located in Seismic Zone 1, and in accordance with recommended Phase I guidelines does not warrant seismic stability analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Based on the visual inspection, the dam appears to be in FAIR condition. Several features could adversely affect the future condition of the dam:

1. Inadequate spillway capacity.

2. Lack of riprap protection at the right abutment of the left embankment and at the left and right abutments of the right embankment.

3. Brush growing on the upstream slopes of the left and right embankments and at the toe of the left embankment.

4. Depressions along the crest that could indicate minor instability.

5. Partially inoperable outlet works gate.

b. Adequacy of Information. The available information is such that the assessment of the condition of the dam must be based on visual observation.

c. Urgency. The recommendations and remedial measures described below should be implemented by the Owner within one year after receipt of the Phase I report.

7.2 Recommendations. The following items should be accomplished under the direction of a registered engineer qualified in the design and construction of dams and any recommendations resulting from analysis performed should be implemented by the Owner:

1. Perform detailed hydrologic and hydraulic studies to further assess the need for and means to increase the project discharge capacity.

2. Extend riprap to protect the abutments of the left and right embankments and redress the stone along the upstream slope.

3. Cut brush growing on the upstream slopes of the left and right embankments and at the downstream toe of the left embankment.

4. Periodically monitor the wet areas, observed during the Phase I inspection, that occur at the downstream toe of the left and right embankments.

5. Investigate the cause of the depressions along the crest and take appropriate measures to correct it.

6. Inspect the overflow spillway during a no flow period.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

1. Maintain clearance of brush, vines and trees on the crest, slopes and at the toe of the left and right embankments.

2. Institute a program of annual technical inspection by a qualified registered engineer.

3. Repair the outlet works gate stem.

4. Develop and implement a formal warning system to notify all concerned parties during critical periods.

5. Develop and implement a regular maintenance program.

7.4 Alternatives

There are no alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Wyassup Lake Dam DATE April 9, 1980

TIME 11:30 A.M.

WEATHER Cloudy

W.S.ELEV. 301.1 U.S. 290.4 D.S.

PARTY:

1. A. Reed, CEM
2. E. Dessert, CEM
3. L. Topp, CEM
4. R. Brown, CEM
5. S. Khanna, CEM
6. G. Castro, GEI
7. R. Stetkar, GEI
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECKLIST

PROJECT Wyassup Lake Dam DATE April 9, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	303.75
Current Pool Elevation	301.1
Maximum Impoundment to Date	Unknown
Surface Cracks	Two ft. wide depression in crest extending 15 feet in length along embankment axis at sta. 2+65, 6 feet from downstream edge of crest. Similar depression in crest 15 feet left of gate valve.
Movement or Settlement of Crest	None other than depressions noted above.
Lateral Movement	Too irregular to judge.
Vertical Alignment	Too irregular to judge.
Horizontal Alignment	Too irregular to judge.
Condition at Abutment and at Concrete Structures	Erosion beneath downstream ends of spillway training walls; some erosion in upstream slope at right abutment.
Trespassing on Slopes	No significant trespassing.
Sloughing or Erosion of Slopes or Abutments	Sloughing of downstream slope near crest at sta. 2+70. Erosion on upstream slope at contacts of embankment with section of natural ground located at center portion of dam.
Rock Slope Protection - Riprap Failures	Riprap on upstream slope in good condition. No riprap near right abutment contact or at contacts with natural ground at center portion of dam.
Unusual Movement or Cracking at or Near Toe	None observed.

PERIODIC INSPECTION CHECKLIST

PROJECT Wyassup Lake Dam DATE April 9, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT (Cont.)	
Unusual Embankment or Downstream Seepage	Wet area at downstream toe near right abutment, sta. 0+00 to 0+15. Wet area 15 feet downstream of toe of dam left of spillway, standing water 50 feet downstream from toe at sta. 2+50.
Piping or Boils	None observed.
Foundation Drainage Features	None known.
Toe Drains	Toe drains in embankment left of natural ground at center portion of dam appear to be functioning.
Instrumentation System	*None known.*
Vegetation	Grass-covered upstream, downstream slopes and crest, some small bushes on upstream slope.

PERIODIC INSPECTION CHECKLIST

PROJECT Wyassup Lake Dam DATE April 9, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	Reinforced concrete headwall structure at upstream to of dam. Invert elevation 292.75. At headwall a 24 inch diameter ACCMP carries inflows to outlet works control manhole near center of dam. All underground and not observable. No drains or weep holes observed.

PERIODIC INSPECTION CHECKLIST

PROJECT Wyassup Lake Dam DATE April 9, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	Control for outlet works is provided by a 4 x 4 ft. concrete manhole in crest of dam. The upstream wall of the manhole supports a vertical slide sluice gate (24 in. dia.). The stem of this gate was severely bent, restricting the height that the gate could be opened. The protective cover over the stem was also vandalized and requires repair.

PERIODIC INSPECTION CHECKLIST

PROJECT Wyassup Lake Dam DATE April 9, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Outlet channel same as spillway outlet channel - natural stream bed. A 24 inch dia. ACCMP outlet pipe carries discharges from the manhole to the outlet headwall located in the side-wall of the overflow spillway.
Drain Holes	None
Channel	Natural stream channel.
Loose Rock or Trees Overhanging Channel	Trees overhanging channel.
Condition of Discharge Channel	Good

PERIODIC INSPECTION CHECKLIST

PROJECT Wyassup Lake Dam DATE April 9, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	No approach channel, Reservoir bed.
b. Weir and Training Walls	Overflow spillway is reinforced concrete 20 ft. weir, sharp crested with downstream slope of 1V on 2H. Constructed in 1963. The concrete is in good condition. No drain holes observed.
c. Discharge Channel	Natural stream bed; same as outlet channel.
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Yes
Floor of Channel	Natural stream bed, gravelly.
Other Comments	Erosion of concrete along base of spillway training walls and at downstream end of training walls.
Other Obstructions	Culvert under road may restrict flow.

PERIODIC INSPECTION CHECKLIST

PROJECT Wyassup Lake Dam DATE April 9, 1980

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	Timber service bridge crosses spillway 20 ft. span, Good condition. Protected from weathering by paint.

APPENDIX B

ENGINEERING DATA

APPENDIX B-1

Correspondence pertaining to the history, maintenance, and modifications to the Wyassup Lake Dam as well as copies of past inspection reports are located at:

State of Connecticut
Department of Environmental Protection
State Office Building
165 Capitol Avenue
Hartford, Connecticut
Attention: Mr. Victor J. Galgowski,
Dam Safety Engineer

APPENDIX B-2

SELECTED COPIES OF PAST INSPECTION REPORTS

SUGGESTION COMMITTEE SAY: Improve Your Own Condition; Earn Cash and Recognition: Send in a Suggestion!

Interdepartment Message

STO-200 REV. 11/73 (Stock No. 6938-050-01)

SAVE TIME: Handwritten messages are acceptable.
Use carbon if you really need a copy. If typewritten, ignore faint lines.

To	NAME: File	TITLE	DATE: Feb. 6, 1975
	AGENCY	ADDRESS	
From	NAME: Robert E. Samuelson	TITLE: Engineer Intern	TELEPHONE
	AGENCY: Water & Related Resources	ADDRESS: "	

SUBJECT: Wyassup Lake Dam: North Stonington

This dam was in fact completed by public Works in 1963. We never received a reply from Macchi Engineers to issue a Certificate of Approval.

The dam is in excellent condition as of last inspection and no formal Certificate will be issued. None is necessary.

SAVE TIME: If convenient, handwrite reply to sender on this same sheet.

CHANDLER & PALMER
CIVIL ENGINEERS
114-116 THAYER BUILDING
TELEPHONE TURNER 7-8640

MEMBERS AMERICAN AND CONNECTICUT SOCIETIES OF CIVIL ENGINEERS

BENJAMIN H. PALMER
SHEPARD B. PALMER

DAMS
WATER SUPPLIES
SEWERAGE
APPRAISALS
REPORTS
SURVEYS

NORWICH, CONN.

November 13, 1957

Re: Wyassup Lake

Water Resources Commission
State Office Building
Hartford, Connecticut

Attention: Mr. Merwin Hupfer

Dear Sir:-

Wyassup Lake is located in the Town of North Stonington about three miles North of the Village of North Stonington. This lake is roughly in the shape of a circle with a diameter of 1/2 mile.

The main dam is about 250 feet long and is earth filled with a dry stone wall on the downstream side. Maximum height of dam is 12 feet.

Water was coming through the gate or sluiceway rather rapidly and the pond was at least 6 feet below full pond. I could see no gate or other means of control to shut off this water. The spillway is 5' 4" wide and only 12" deep and the drainage area is about 1.2 square miles. In my opinion a considerable amount of work needs to be done to make this dam safe and usable.

(1) Present trees along the dam have pushed the downstream wall badly out of line. All trees on the dam should be cut. Trees and debris below dam for 25 feet should be cut and cleared away. At least 500 yards of good fill material should be placed along downstream face of South end of dam. This is to reinforce the badly tilted wall.

(2) A complete new operating gate and drawdown pipe should be installed with proper access, so as to be able to reach the gate etc. As far as I can see, there is no control now at all.

(3) The present spillway is totally inadequate. It should be a minimum of 30 feet wide and 2 feet deep with adequate provision downstream so that no washouts will occur. I assume that now the water just goes through the dam and a severe storm simply builds up in the pond.

There is a second small dam about 100 feet long and 6 feet high which also needs some maintenance and fill placed against it. At least $8,000 would be necessary to put this dam in any kind of condition. If repairs are made as outlined above, I would recommend that a Construction Permit be issued. The State should plan to spend at least this amount if they decide to take this property over. A considerable amount of work needs to be done on it.

Very truly yours,

B. H. Palmer

BHP/ew

State of Connecticut
Water Resources Commission
Hartford, Connecticut

October 17, 1961

compacted soil mixture. It may also be possible to place a sealer matt on the upstream face of the dam.

The dam at the South end of the lake should be reviewed for the increased flood dlow. It is also in need of repairs as it leaks badly and has been eroded in many areas.

A closed conduit is not recommended as a spillway. The U. S. Bureau of Reclamation recommends RCP in construction of dams as it has longer life.

Billings Lake:

Design flood flow indicated is correct, however, intensity and duration as 4" per hour for a 6 hour period, we find incorrect.

The type spillway shown would be subject to easy clogging by floating leaves, branches, debris and ice and would easily become ineffective. Spillway should bè a positive design which would wash itself clean and not easily clogged. A closed conduit is not recommended as a spillway.

The U. S. Bureau of Reclamation recommends RCP in construction of dams as it has longer life.

Wyassup Lake:

Design flood flow indicated is correct, however, intensity and duration as 4" per hour for a 6 hour period, we find incorrect.

The spillway provided is adequate.

The impervious core of compacted clay placed on the downstream face of the existing masonry dam is itself unstable and dependent on the pervious granular fill material over it to hold it in place. The granular matt is of inadequate thickness to stabilize the core. I suggest the impervious core to be greatly reduced in thickness or completely removed and replaced with a single material on the downstream side; of well graded stones, gravel, sand with enough fines to make a tight stable compacted soil mixture. It may also be possible to place a sealer matt on the upstream face of the dam. This would then allow the use of pervious fill to stabilize the existing masonry walls.

Very truly yours,

[redacted] MACCHI, ENGINEERS

K. J. MACCHI

A. J. MACCHI • ENGINEERS
DR. GIULIO PIZZETTI — ASSOCIATE CONSULTANT

44 GILLETT STREET — HARTFORD, CONN. — PHONE JA 5-6631
17 CORSO DUCA ABRUZZI — TORINO, ITALY — PHONE 519-473

N.S.P.E. — A.S.C.E. — A.C.I.

October 17, 1961

State of Connecticut
Water Resources Commission
State Office Building
Hartford, Connecticut

Attention Mr. Emitt Dell

Re: Review of Designs
Repair & Alterations of
Following Existing Dams

Hall Pond-Eastford, Conn.
Billings Lake-No. Stonington, Conn.
Wyassup Lake-No. Stonington, Conn.

Dear Mr. Dell:

In accordance with the request in your letter of October 6, 1961 we have reviewed the plans and specifications for the above-referenced dams. Following is a summary for your consideration:

Hall Pond Dam:

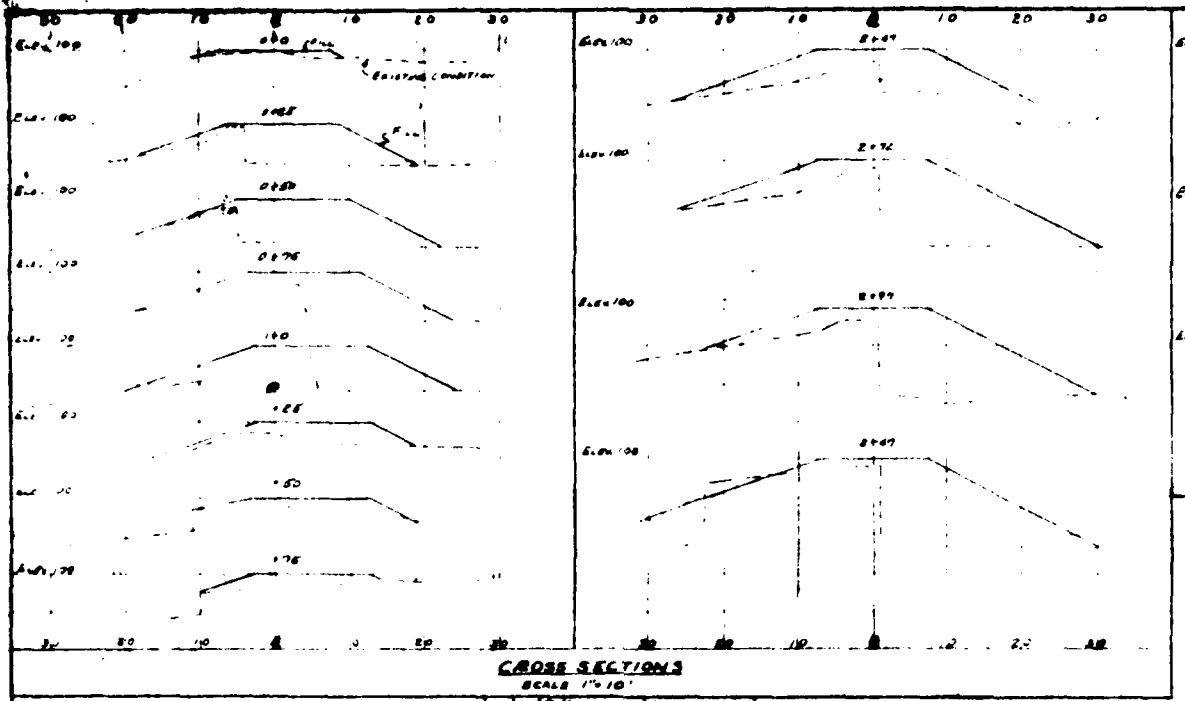
Design flood flow indicated is correct, however, intensity and duration indicated as 4" per hour for a 6 hour period, we find incorrect.

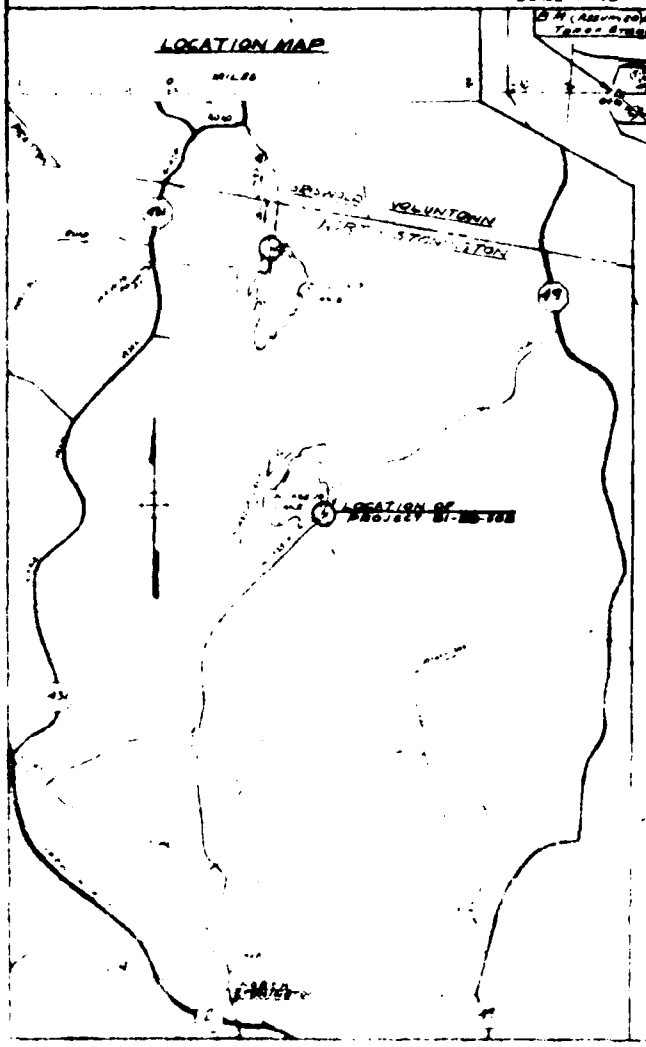
The spillway shown is adequate dependent on increased lake stroage, thus, increased elevation should be checked with South Dam which has no spillway. However, the spillway shown would be subject to easy clogging by floating leaves, debris, branches and ice and would easily become ineffective. Spillway should be of positive design similar to that existing which would wash itself clean.

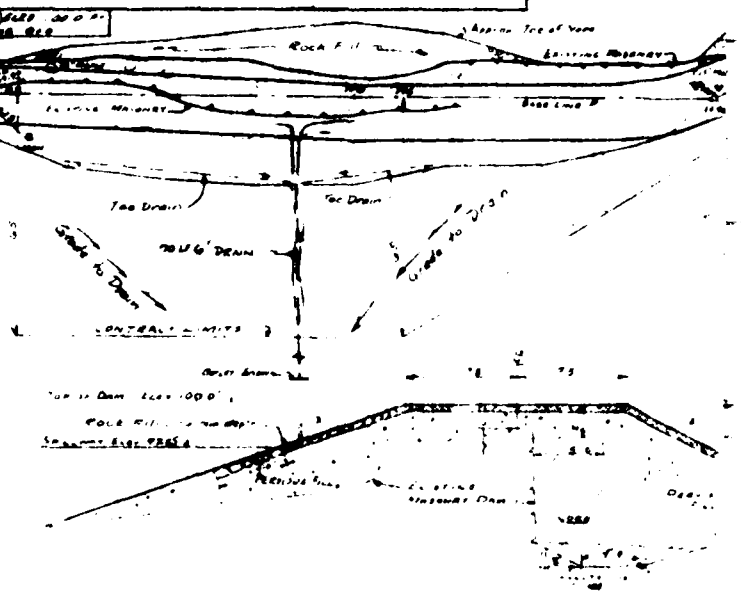
The impervious core of compacted clay placed on the downstream face of the existing masonry dam is itself unstable and must be held in place by the pervious granular fill material over it. The granular matt is of inadequate thickness to stabilize the core. I suggest the impervious core be greatly reduced in thickness or completely removed and replaced with a single material on the down stream side; of well graded stones, gravel, sand and enough fines to make a tight stable

APPENDIX B-3

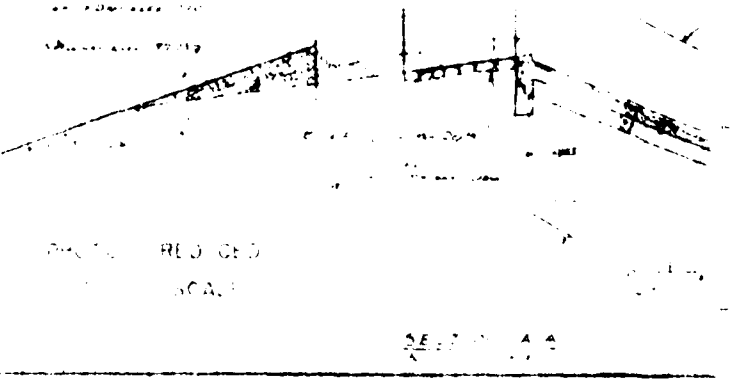
PLANS, SECTIONS AND DETAILS

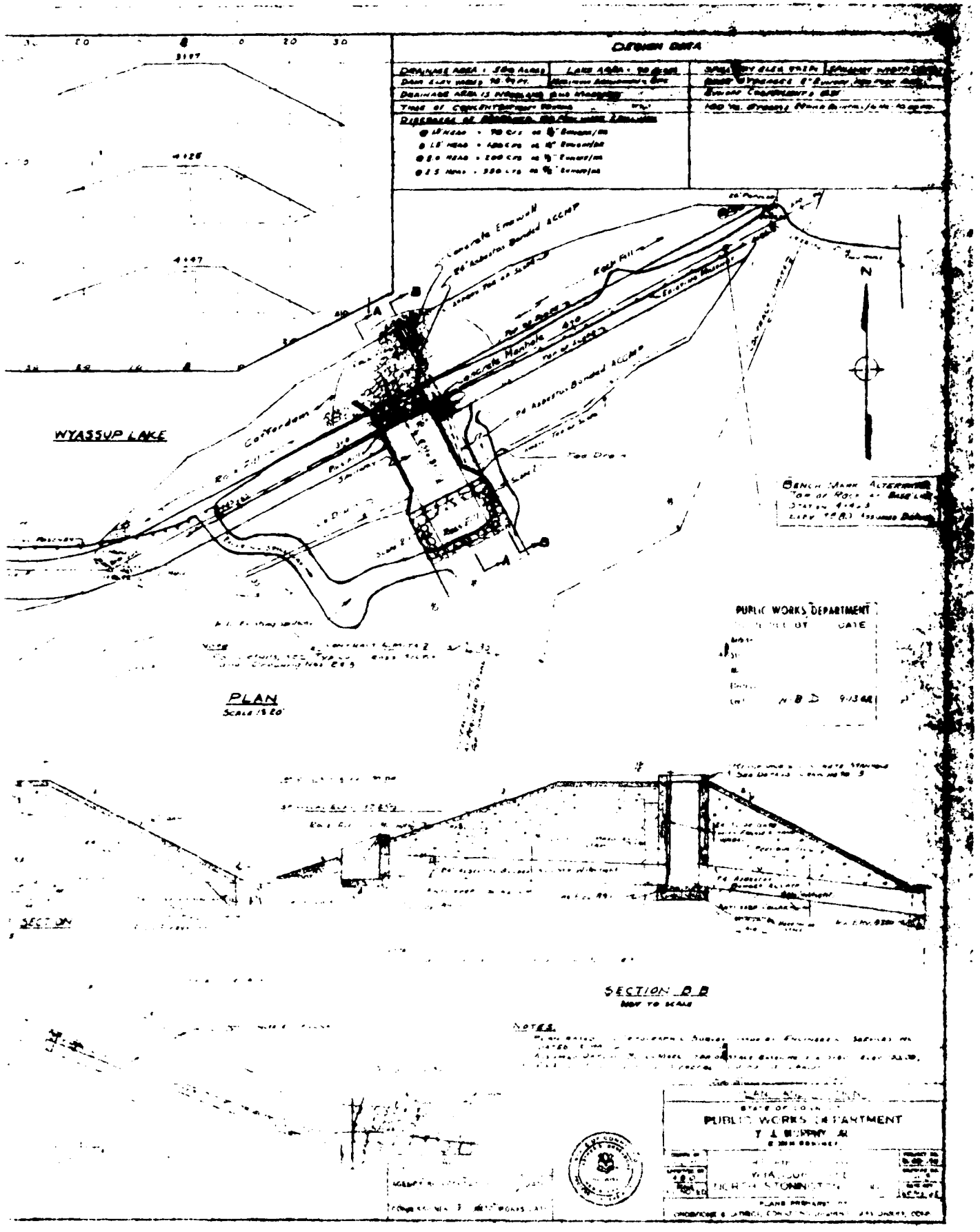






TYPICAL CROSS SECTION
SCALE: 1"=8'




DESIGN DATA
WYASSUP LAKE
Concrete Manhole
PLAN
Scale 1" = 50'
PUBLIC WORKS DEPARTMENT
SECTION
SECTION B-B
NOT TO SCALE
NOTES
PUBLIC WORKS DEPARTMENT

2

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

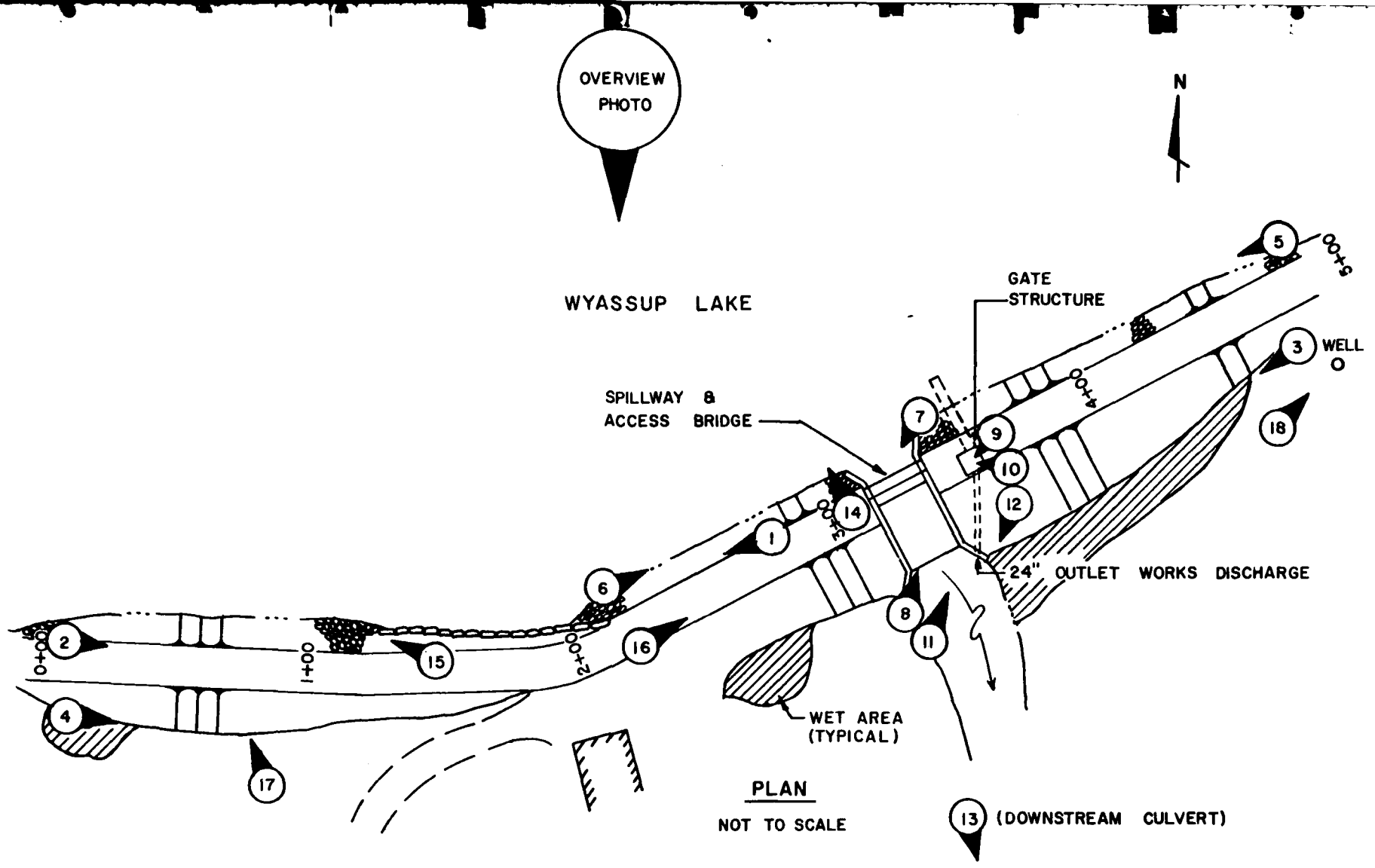

OVERVIEW PHOTO
N
WYASSUP LAKE
GATE STRUCTURE
SPILLWAY & ACCESS BRIDGE
WELL
24" OUTLET WORKS DISCHARGE
WET AREA (TYPICAL)
PLAN
NOT TO SCALE
(DOWNSTREAM CULVERT)
WYASSUP LAKE DAM
PHOTO INDEX

PHOTO C-1 Crest of dam looking toward right abutment.

PHOTO C-2 Crest and upstream face of dam looking toward left abutment.

PHOTO C-3 Downstream slope looking from left abutment.

PHOTO C-4 Downstream slope looking from right abutment.

PHOTO C-5 Typical riprap protection on upstream slope.

PHOTO C-6 Upstream slope of dam.

PHOTO C-7 Upstream side of overflow spillway and service bridge.

PHOTO C-8 Downstream slope of overflow spillway.

PHOTO C-9 Outlet works manhole on crest of dam.

PHOTO C-10 Outlet works sluice gate.

PHOTO C-11 24 inch diameter outlet works discharge.

PHOTO C-12 Downstream channel.

PHOTO C-13 Downstream culvert.

PHOTO C-14 Wyassup Lake.

PHOTO C-15 Erosion at upstream slope from wave action.

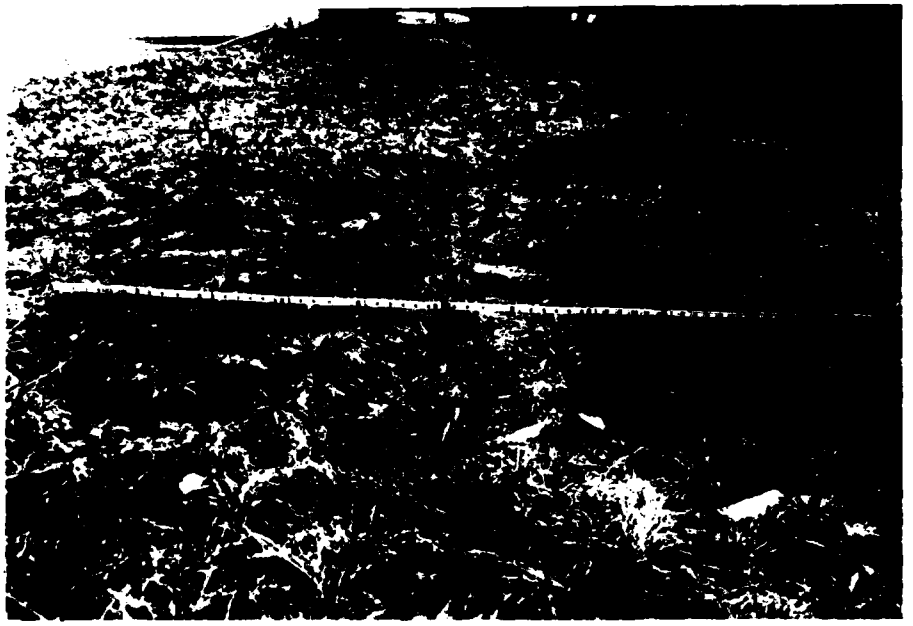


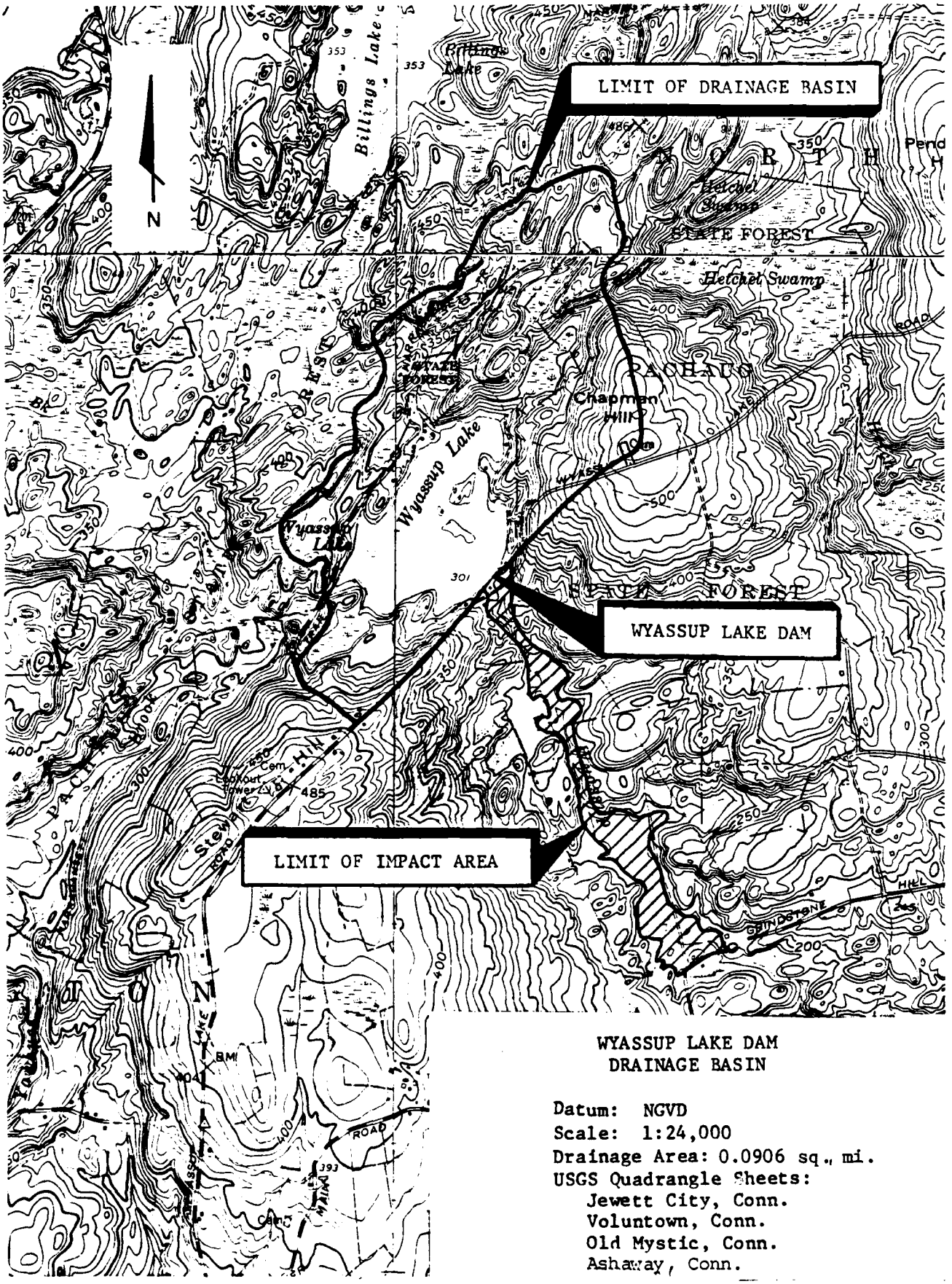
PHOTO C-16 Depression in crest at location of old masonry dam.

PHOTO C-17 Rotting stump at toe of embankment.

PHOTO C-18 Eroded gully at toe of dam from well overflow.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



WYASSUP LAKE DAM
DRAINAGE BASIN

Datum: NGVD
Scale: 1:24,000
Drainage Area: 0.0906 sq. mi.
USGS Quadrangle Sheets:
Jewett City, Conn.
Voluntown, Conn.
Old Mystic, Conn.
Ashaway, Conn.

PLATE D-1

Wyassup Lake Dam

A. Size Classification

Height of dam = 15.0 ft.; hence SMALL

Storage capacity at top of dam (elev.303.75) = 800 AC-FT.; hence SMALL

Adopted size classification SMALL

B. Hazard Potential

The dam is located in a wooded area and hilly area and failure may result in the possible loss of a few lives and damage to 1 to 3 dwellings. Flooding and damage may occur at Wyassup Lake Road; as well as disruption of the utilities located within the rights of way of these roadways. The failure will cause flooding conditions downstream and high velocity flows carrying debris will cause further damage by scouring, erosion and undermining.

C. Adopted Classifications

HAZARD	SIZE	TEST FLOOD RANGE
SIGNIFICANT	SMALL	100 year to Half PMF

Adopted Test Flood = Half PMF = 2400 CSM

= 2150 CFS

D. Overtopping Potential

Drainage Area 580 Acres = 0.906 sq. miles

Spillway crest elevation = 301.0 NGVD

Top of Dam Elevation = 303.75 NGVD

Maximum spillway discharge Capacity without overtopping of dam = 296 CFS

"test flood" inflow discharge = 2150 CFS

"test flood" outflow discharge = 925 CFS

% of "test flood" overflow carried by spillway without overtopping = 32%

"test flood" outflow discharge portion which overflows over the dam = 629 CFS

% of test flood which overflows over the dam = 68

Estimating Maximum Probable Discharges - Inflow and Outflow Values Date of Inspection: April 9, 1980

Name of Dam Wyassup Lake Dam ; Location of Dam Wyassup Lake ; Town North Stonington, Ct.

Watershed Characterization Wooded; hilly-rolling terrain; moderate slopes ; 0.09 sq. miles of drainage area is swampy or occupied by storage reservoirs

Adopted "test" flood = Half PMF = 2400 CSM = 2150 CFS; Re = Effective Rainfall = 9.5 inches

D.A. = Drainage Area (Gross) = 0.906 Square Miles; Basin Slope = 0.04 hence; moderate

S.A. = Surface Area of Reservoir = 0.14 Square Miles; Time of Concentration 35 minutes

Shape and Type of Spillway = Free, uncontrolled, overflow; Broad crest with 1:2 downstream slope

B = Width of Spillway = 20 feet; C = Coefficient of Discharge = (-Friction) = 3.25

D-3

Maximum Capacity of Spillway Without Overtopping = 300 CFS = 32 % of test flood

Top of Dam Elevation = 303.75 ; Spillway Crest Elevation = 301.0

Overflow portion of Length of Dam = 475 ; C = Coefficient of discharge for Dam = 3.00

Name of Dam	Test Flood Q_p		Inflow Characteristics		Outflow Characteristics First Approximation			Outflow Characteristics Second Approximation			Outflow Characteristics Third Approximation (Adopted)		
	CSM	CFS	h_0 in feet	S_0 in in.	Q_{p1} CFS	h_1 in ft.	S_1 in in.	S_2 in in.	h_2 in ft.	Q_{p2} CFS	S_3 in in.	h_3 in ft.	Q_{p3} CFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Wyassup Lake Dam	100yr. =1015	920	3.32	6.15	—	—	—	—	—	—	4.6	2.48	270
	½PMF =2400	2150	3.97	7.36	—	SEE	PLATE	D-11	—	—	6.21	3.35	925

Q_p = Discharge; h= Surcharge height; S = Storage in inches

NOTE: Outflow discharge values are computed as per COE guidelines.

NAME OF DAM: Wyassup Lake Dam

ESTIMATING EFFECT OF SURCHARGE STORAGE ON "TEST FLOOD"

A. This routing of floods through the reservoir was carried out according to the guidelines established by the Corps of Engineers in Phase 1 Inspection for Dam Safety Investigations issued in March, 1978.

B. Formulas used are as follows:

i. For no overtopping: $Q = C_1 B_1 h_1^{3/2}$
For overtopping: $Q = C_1 B_1 [h_2 + F.B.]^{3/2} + C_2 B_2 h_2^{3/2}$
For open channel flow: N/A
For orifice flow: N/A
where C_1 = coefficient of discharge for spillway; B_1 = length of spillway
C_2 = coefficient of discharge for dam; B_2 = length of dam
h_1 = head over spillway crest in (feet); h_2 = head over dam in (feet)
F.B. = distance between spillway crest and top of dam (feet)

ii. Surcharge storage in inches = $S = 12\ (h_1 + h_2)\ \frac{S.A.}{D.A.}$
where S.A. = surface area
D.A. = drainage area in (sq. mi.)

iii. $Q_{outflow} = Q_{inflow}\ (1 - \frac{S}{Re})$; where Re = effective rainfall = 9.5"

iv. Length of dam = 4.86 ft. ; Top of Dam elev. = 303.75 ; c for dam = 3.0
Length of spillway = 20 feet ; Spillway crest el. = 301.0 ; c for spillway = 3.25
$Q = 3.25 \times 20 (2.75 + h_2)^{1.5} + 3 \times 486\ h_2^{1.5}$ where h_2 is head over top of dam
S = Storage in inches = $12h\ \frac{S.A}{D.A} = 1.854h$ where h is head over top of spillway crest.

v. Q_{inflow} = 2150 CFS.

Q in CFS	Elevation	Total Head over crest $h_1 + h_2 = h$	Storage in inches = S	Remarks
1730	302.0	1.0	1.854	
1677	303.0	2.0	3.708	
1140	304.0	3.0	5.562	
603	305.0	4.0	7.416	
67	306.0	5.0	9.270	
925	304.35	3.35	6.210"	

"Rule of Thumb Guidance for Estimating Downstream Dam Failure Discharge"

BASIC DATA

Name of dam Wyassup Lake Dam Name of town North Stonington, Ct.

Drainage area = 0.906 sq. mi., Top of dam 303.75 NGVD

Spillway type = overflow, concrete, broad crest Crest of spillway 301.0 NGVD

Surface area at crest elevation = 0.14 sq. mi. = 90 Acres

Reservoir bottom near dam = 290.0 NGVD

Assumed side slopes of embankments 2:1

Depth of reservoir at dam site = y_o = 15.0 ft.

Mid-height elevation of dam = 297.50 NGVD

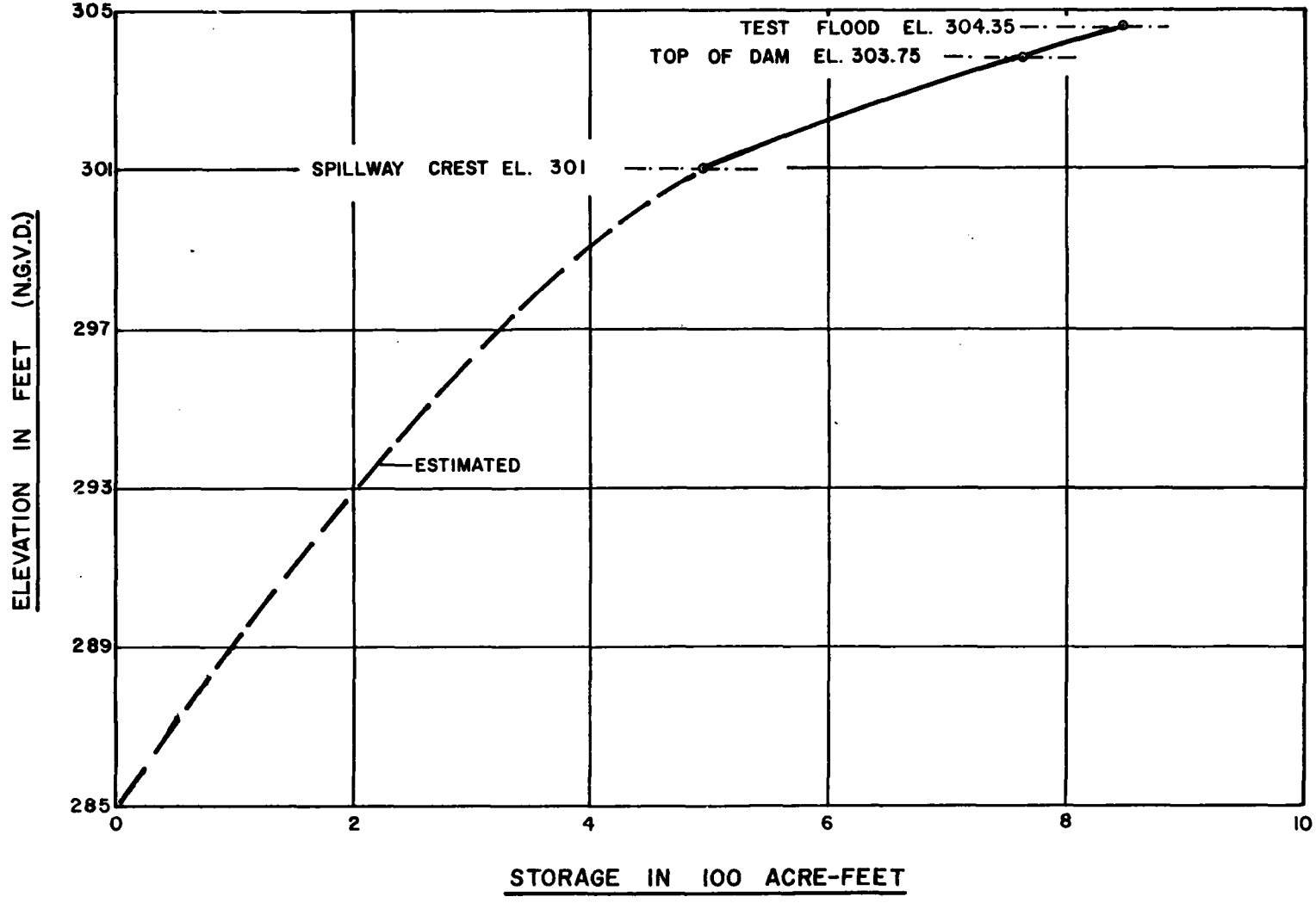
Length of dam at crest = 486 ft.

Length of dam at mid-height = 450 ft.

10% of dam length at mid-height = W_b = 45 ft.

Width of channel immediately downstream = B = 45 ft. Shape of breach = rectangular

Elevation (NGVD)	Estimated Storage in AC-FT	
301.0	553	Spillway Crest Elevation
302.0	643	
303.0	733	
303.75	800	Top of Dam Elevation
304.35	870	Test Flood Elevation



STORAGE-ELEVATION CURVE

WYASSUP LAKE DAM

PLATE D-6

1. DAM FAILURE ANALYSIS

A. Failure Analysis
Discharge $= \frac{8}{27} W_B \sqrt{g}\, y_o^{1.5}$
$= 1.68\, W_B\, y_o^{1.5}$
$= 4392$ C.F.S. C.F.S.

B. Maximum Spillway

Discharge with W.S.E.

At top of Dam @ 303.75 300 C.F.S.

C. Total Dam Failure Discharge 4692 C.F.S.

D. Reservoir - Storage Data:

Volume of storage at spillway crest = 553 AC-ft. @ Elev. 301.00

Surcharge storage at top of dam = 243 AC-ft. @ Elev. 303.75

Storage Total = 800 AC-ft. @ Elev. 303.75

E. Flood Discharge Channel

i. Maximum depth of flow just D/S of Dam = $\frac{4}{9} y_o$ = 6.70 feet

Notes:

1. Failure of dam is assumed to be instantaneous. When pool reaches top of dam, and is a full-depth partial width rectangular shape failure with a width of failure = W = 45 feet and depth of failure y_o = _____ 15.0 feet.

2. Steady, uniform flow phenomenon is assumed for determination of failure profile and is based on Manning's formulae.

3. Failure profile for impacted area determination is determined at three typical cross sections in the downstream channel. Reduction in discharge due to available storage has been taken into account.

ii. Reach 1

Length = 7000 feet; Station 0 to Station 70+00; n = 0.05

Bed slope = $S_o \simeq S_f$ = 0.015; Bed width = b = 40

Bed width is scaled from U.S.G.S. map; scale 1" = 2,000 feet

As bed width is large and 1" = 2,000 feet and 10-foot contour interval scale maps are being used for various channel parameters, it is appropriate to assume that d = R = Hyd Radius = depth, hense Manning's formulae is transformed:

$$Q = A \frac{1.49}{n} R^{2/3} \sqrt{S} = bd \frac{1.49}{n} d^{2/3} \sqrt{S}$$

$$Q = b \frac{1.49}{n} \sqrt{S}\, d^{5/3} = Kd^{5/3} = 146\, d^{5/3} = 146 d^{5/3}$$

State Discharge Relationship for Reach 1

Depth = d in Feet	Stage of Elevation	Discharge in CFS = Q	Velocity in ft./sec.	Storage Volume in AC-ft. = V
0	240	0	0	0
2	242	463	5.78	13.0
4	244	1470	9.18	26.0
6	246	2889	12.03	39.0
8	248	4665	14.60	52.0
10	250	6766	N/A	N/A
12	252	9168	N/A	N/A

F. Water surface profiles resulting from maximum spillway discharge and also from dam failure discharge are shown on Plate D-11 for comparison purposes. This figure also shows the rise in water depth due to failure of dam.

Also, Discharge -- Depth and Storage-depth curves are shown on Plate D-12 for downstream channel.

Notes: 1. Storage volume in AC-ft = $\frac{\text{(Length of Reach) (Bed Width) (Depth)}}{43{,}560}$

2. Failure discharge being large will mostly be overbank flow on existing channel.

c. For Q_1 = 4692 CFS; depth = 8.0 ft. V_1 = 52 AC-ft.

Trial $Q_2 = Q_1 \left(1 - \frac{V_1}{\text{Storage}}\right) = \left(1 - \frac{52}{800}\right) = 4387$ CFS.

$\therefore V_2$ = 46 AC-ft.

Avg $V = \frac{V_1 + V_2}{2}$ = 49 AC-ft.

$\therefore Q_2 = Q_1 \left(1 - \frac{V \text{ Avg.}}{\text{Storage}}\right)$ = 4404 CFS; y_2 = 7.9 ft.

Depth at center of flood as adopted = 8.0 ft.

Additional dam failure analysis beyond Reach 3 is not undertaken because the depth of flow of 7.9 feet at the end of Reach 1 will not cause any hazardous conditions further downstream except downstream flooding conditions. Moreover, failure discharge and depth will continually go on decreasing beyond Reach 1. However almost impacted area due to failure of dam is shown on Plate D-1. No significant damages in life and/or property are anticipated beyond Reach 1 because no houses, roads or establishments are located below the anticipated depths beyond Reach 1 of 7000 feet.

SUMMARIZED AND ADOPTED VALUES

FOR

DAM FAILURE ANALYSIS

i. Name of Dam Wyassup Lake DAM

ii. Dam Failure Discharge _____ = 4392 cfs.

iii. Maximum Spillway Discharge _____ = 300 cfs.

iv. Total Dam Failure Discharge _____ = 4692 cfs.

v. Normal (Manning Depth) for 4692 C.F.S. = 8.0 feet

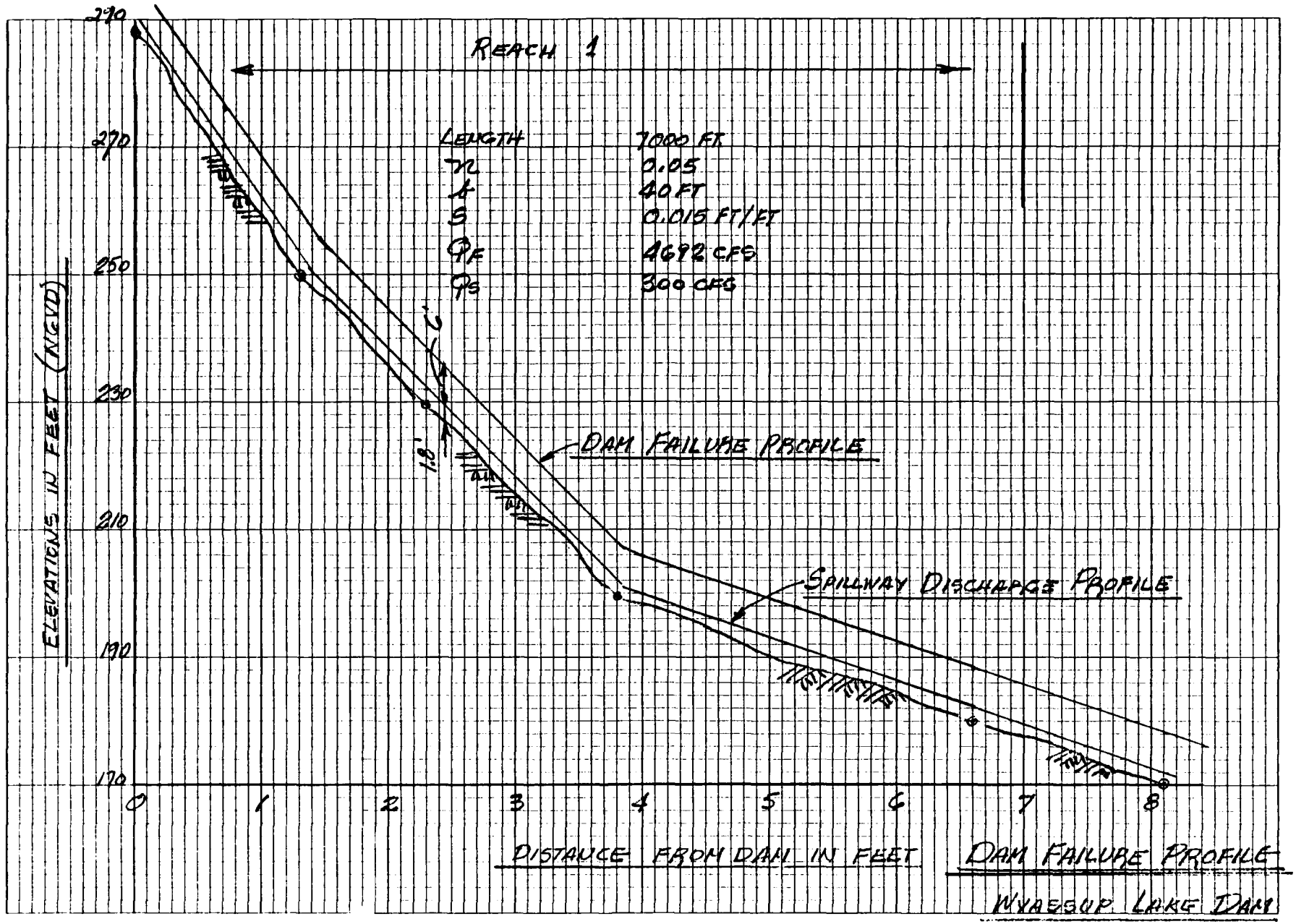
vi. Normal (Manning Depth) for 300 C.F.S. = 1.8 feet

vii. Increase in depth due to failure of dam = 6.2 feet

viii. W.S.E. prior to failure = Ground Elevation + 1.8

ix. W.S.E. after failure = Ground Elevation + 8.0

Note: The adopted depth of flow values are assumed to be accurate representations of damages in the impacted areas. Professional judgement is used in these final adopted values.


REACH 1
LENGTH 7000 FT.
n 0.05
L 40 FT
S 0.015 FT/FT
QF 4692 CFS
Qs 300 CFS
DAM FAILURE PROFILE
SPILLWAY DISCHARGE PROFILE
ELEVATIONS IN FEET (NGVD)
DISTANCE FROM DAM IN FEET
DAM FAILURE PROFILE
WYAESUP LAKE DAM

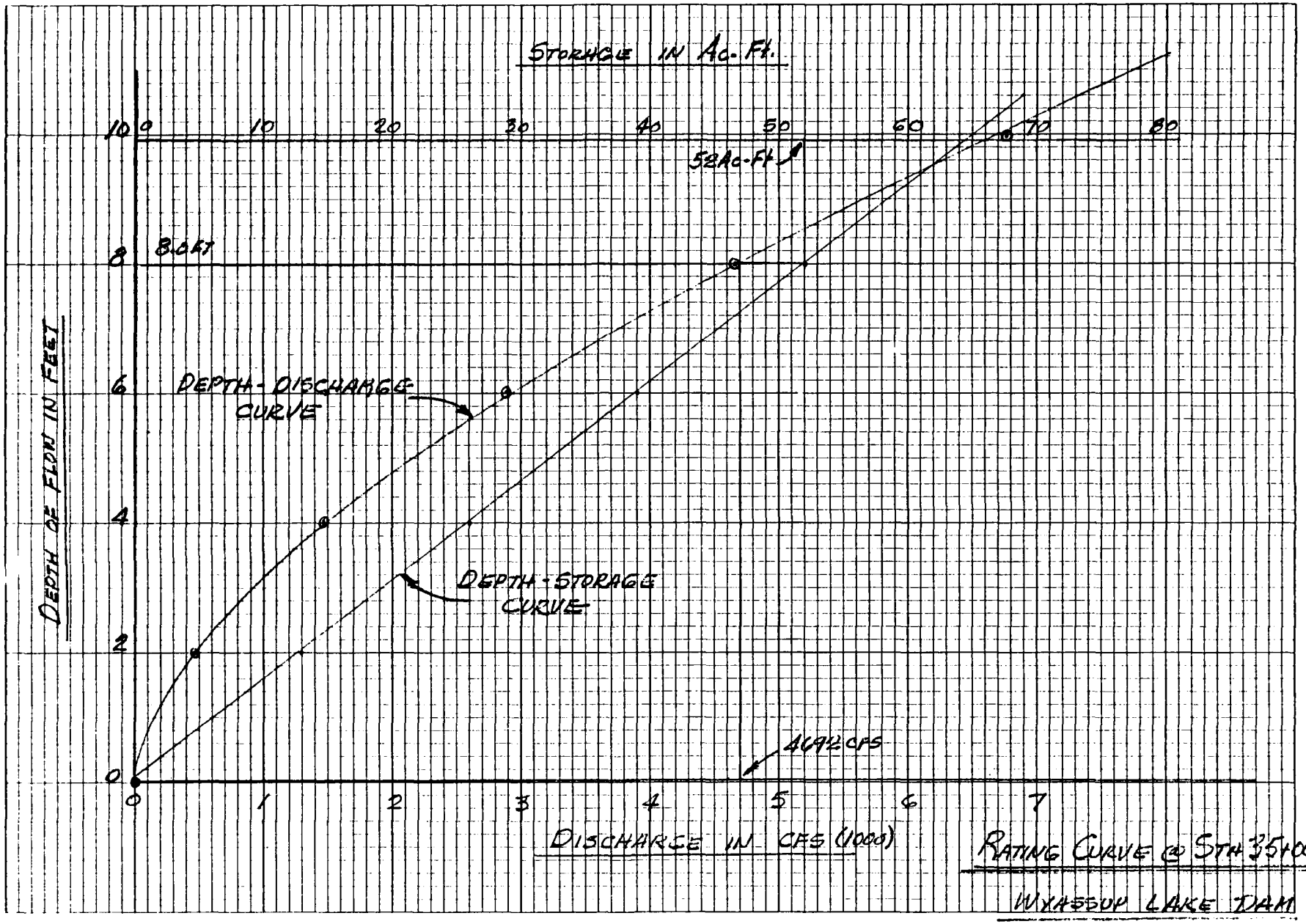

STORAGE IN Ac. Ft.
0
10
20
30
40
50
60
70
80
52Ac-Ft
8.0 Ft
DEPTH OF FLOW IN FEET
0
2
4
6
8
10
DEPTH - DISCHARGE CURVE
DEPTH - STORAGE CURVE
469 CFS
0
1
2
3
4
5
6
7
DISCHARGE IN CFS (1000)
RATING CURVE @ STH 35+00
WYASSUP LAKE DAM

PLATE D-12

Wyassup Lake Dam

COMPUTATIONS FOR
SPILLWAY RATING CURVE AND
OUTLET RATING CURVE COMPUTATIONS

Spillway width = 20.0 feet; Spillway crest elevation = 301.0 NGVD

Length of dam = 486 feet; Top of dam elevation = 303.75 NGVD

C = 3.25 for Spillway ; C = 3.0 for dam overflow

i) SPILLWAY RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Spillway Discharge (CFS)	Remarks
301.0	0	Spillway Crest Elevation
302.0	65	
303.0	184	
303.75	296	Top of Dam Elevation
304.0	338	
305.0	520	Test Flood Elevation

ii) OUTLET RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Discharge (CFS)	Remarks
290.75	0	Invert of Outlet
293.0	19.70	
295.0	30.10	
297.0	37.80	
299.0	44.10	
301.0	49.65	Spillway Crest Elevation
303.75	56.38	Top of Dam Elevation
304.	58.15	Test Flood Elevation

Size of outlet = 24 inch pipe ; Area of outlet = 3.14 sq. ft.

Invert of outlet = 290.75 ; Center line of outlet = 291.75

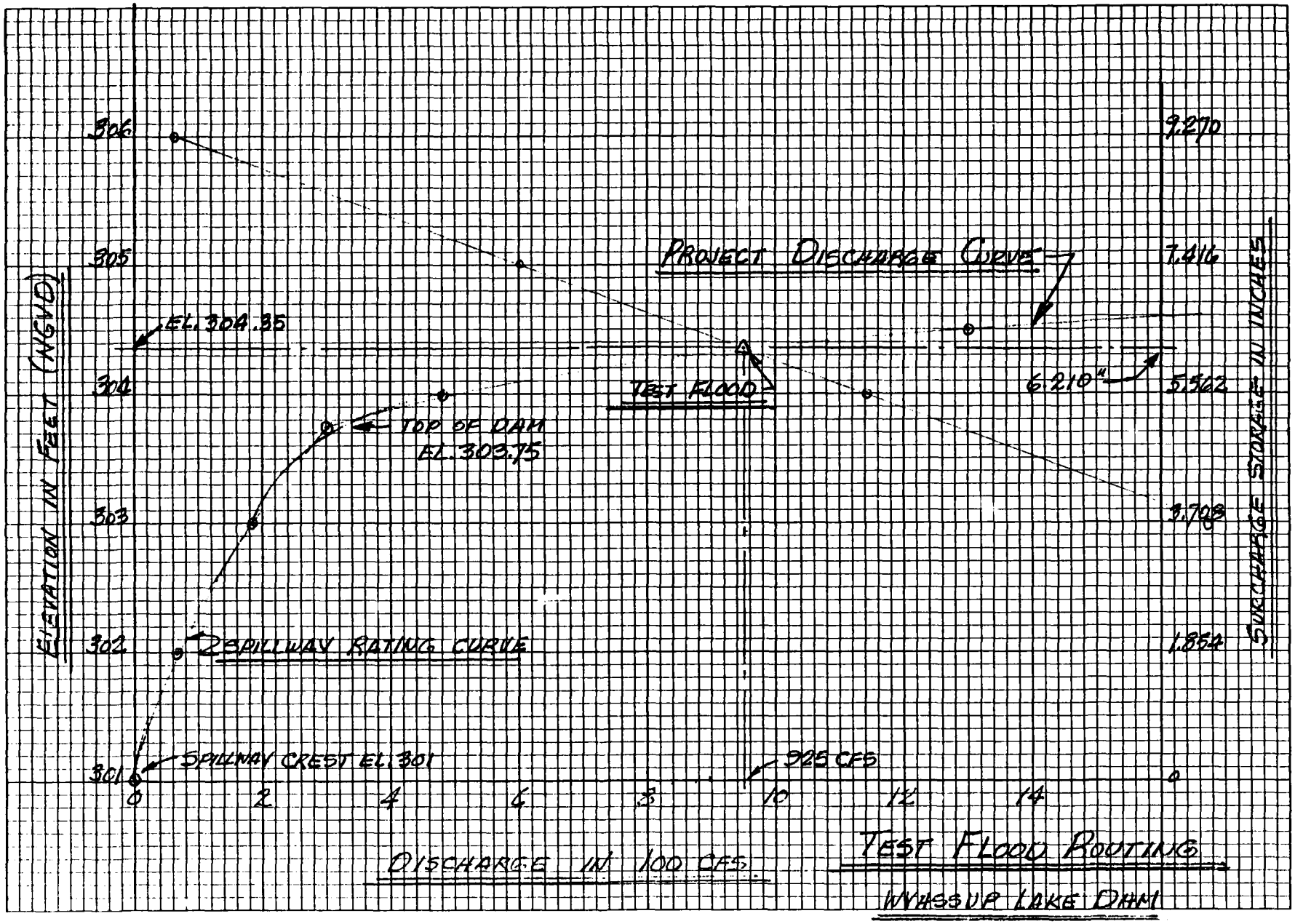
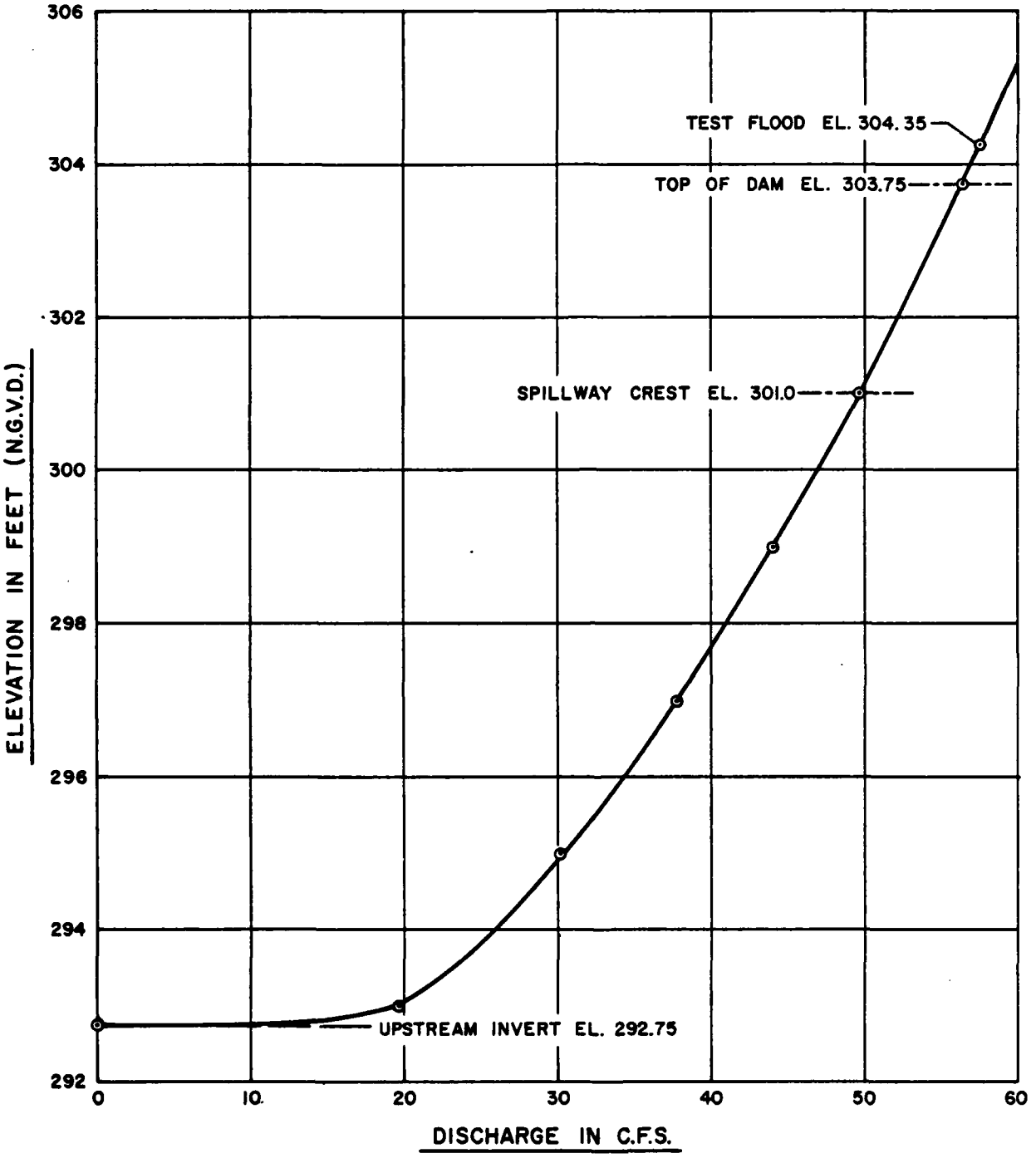

306
305
304
303
302
301
EL. 304.35
TOP OF DAM
EL. 303.75
SPILLWAY RATING CURVE
SPILLWAY CREST EL. 301
PROJECT DISCHARGE CURVE
TEST FLOOD
6210"
325 CFS
9,270
7,416
5,562
3,708
1,854
0
0
2
4
6
8
10
12
14
ELEVATION IN FEET (MSL)
DISCHARGE IN 100 CFS.
SURCHARGE STORAGE IN ACRE FEET
TEST FLOOD ROUTING
WYASSUP LAKE DAM

PLATE D-14



OUTLET RATING CURVE
WYASSUP LAKE DAM

PLATE D-15

APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR. DIST.	OTHER	COUNTY	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY | MO | YR
CT	570	NED	CT	011	02				WYASSUP LAKE DAM	4129.6	7152.4	00JUL80

POPULAR NAME	NAME OF IMPOUNDMENT
	WYASSUP LAKE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	10	WYASSUP BROOK	CLARK FALLS	3	250

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)
RE	1920	R	15	12	800	533

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	N	9APR80

REMARKS

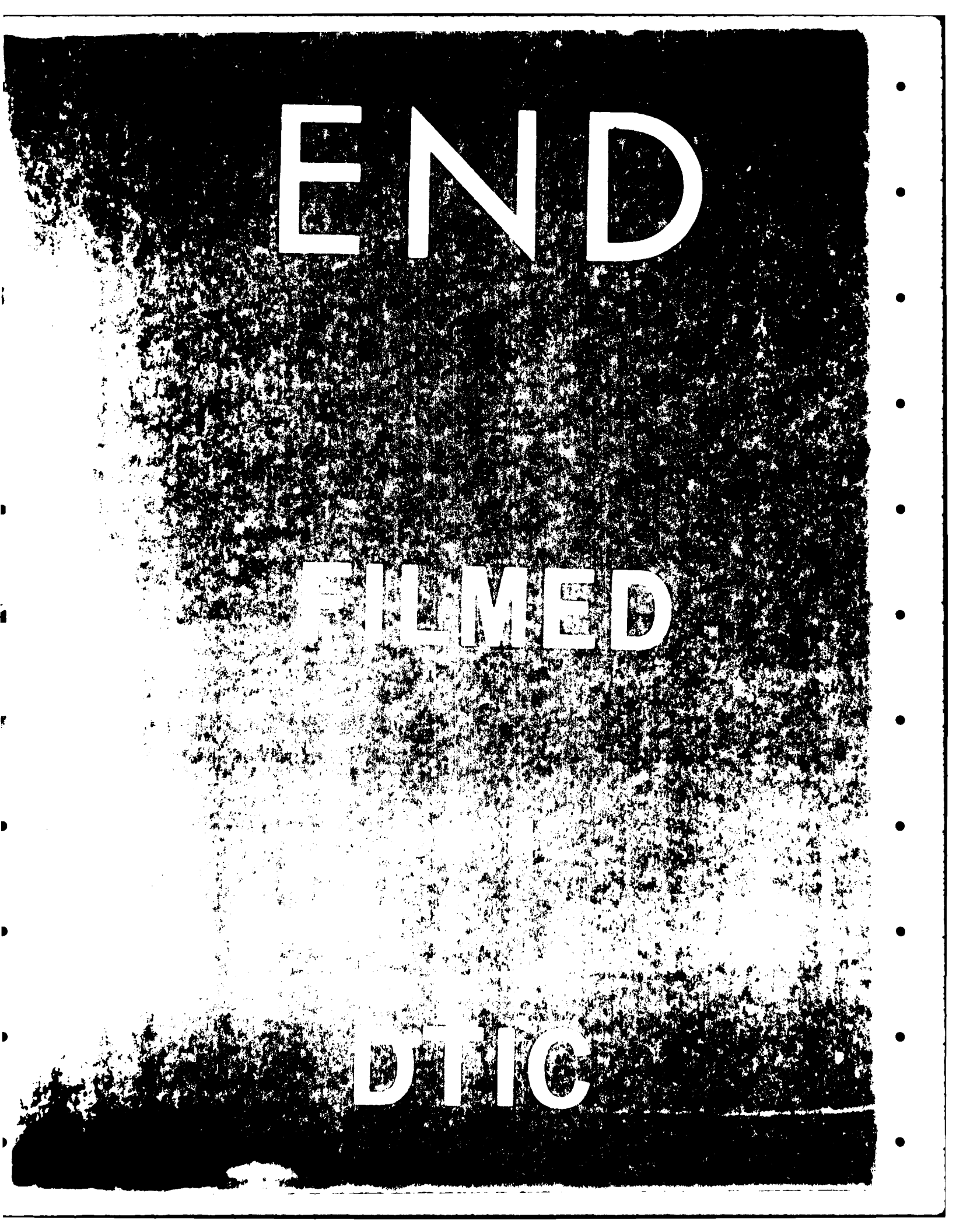
D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	495	U	20	300												

OWNER	ENGINEERING BY	CONSTRUCTION BY
STATE OF CONNECTICUT	ONORDONK + LATHROP	UNKNOWN

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY | MO | YR	AUTHORITY FOR INSPECTION
CE MAGUIRE INC	09APR80	PL 92-367

REMARKS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